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Editorial Notes.

The Conquest of the Tick.

In that well-known book of successful biography, entitled "Self-Help," by Samuel Smiles, there is no more enthralling tale than the career of John Hunter, who left his carpenter's bench to become the greatest anatomist of his generation. His constant message to his students was: "Why think, try." It is a motto which should be graven in gold in every homestead of South Africa. Again and again we hear the thoughtless statement that this crop will not grow or that sickness cannot be eradicated. But have we ever tried? For a decade and more the sombre shadow of disease has darkened this fair land. It paralysed activity and bred in our people a nerveless fatalism. The greatest bacteriologist of the age was hurried from Berlin to Bulawayo. He came armed with test-tube, microscope, and microtome. Yet he failed, save perhaps for that racy farewell message: "The disease will sweep to the sea." But at the other end of the sickness zone a plain man stood face to face with the same problem. To him it meant penury or affluence. Around him the cattle were dying in hundreds. Suddenly, on his own farm, he arrested the plague by a simple experiment. He persevered and was soon successful beyond his wildest dreams. By his practical discovery South Africa becomes at one bound the grandest cattle country in the British Empire. The conqueror of the tick by means of dipping is Joseph Baynes, of Nels Rust, Natal.

During a visit last month to this Province we were amazed at the marvellous progress that has been made in the eradication of tick-borne diseases by dipping, and we feel sure that our readers will welcome a short review of what has been done. The story of the discovery of the value of dipping forms a fascinating chapter in the annals of South African agriculture.

In the year 1901 Mr. Baynes dispatched an agent to Queensland to purchase a shipload of cattle from the tick-infested areas for his

dairy farm at Nels Rust. It was supposed that these cattle would prove immune to South African redwater. It was soon seen, however, that this idea was erroneous. On arrival, the Australian cattle were found to be suffering from both redwater and lung-sickness, and practically all succumbed to these diseases. Nevertheless, this unprofitable venture proved to be the most profitable speculation that Mr. Baynes ever undertook, as it turned his attention to the methods of tick destruction then in vogue in Queensland. Learning that the Government of that State were eradicating the tick by means of dipping, he straightway set to work, erected a dipping tank, the first in South Africa, and prepared a dip according to the Queensland formula. In all this work Mr. Baynes was ably assisted by his manager, Mr. C. D. Alexander, who drew up the plan of the dipping tank and constructed a perfect model. which was later exhibited to the farmers in various parts of the country. The success of these experiments was instantaneous. Thereupon Messrs. Baynes and Alexander informed the Governor of Natal, and asked him to make their results widely known to the Governments of the other South African Colonies and to Rhodesia. But at that time few appreciated the magnitude of the discovery, while many freely ridiculed the possibility of stamping out tick-borne diseases by means of dipping. And so for a long time their voice was like unto one crying in a wilderness rendered desolate by disease.

A Three-day Dip.

The first dip used at Nels Rust to combat redwater was the Queensland dip, but when East Coast fever broke out in Natal it became necessary to find a dip which could be used much more frequently. The Queensland dip was found to be too severe for dipping at short intervals. It was liable to burn the skin, and, indeed, sometimes killed the animal. Another objection was the time it took in making. Thus arose the urgent need for a simple, short-interval dip. Accordingly, Baynes and Alexander began to reduce the strength of the Queensland dip, and were successfully dipping at intervals varying from seven to fourteen days. It was evident, however that entire success would only be possible with still more frequent dipping in order to exterminate the parasites. At this moment there came on the scene a man who was destined to complete the trinity of workers, and, at the same time, to close the final chapter in the conquest of the tick. The name of this man is Lieutenant-Colonel Watkins-Pitchford, F.R.C.V.S., formerly Government Veterinary Bacteriologist to Natal. Watkins-Pitchford was a welcome visitor at Nels Rust, and began his observations there, which, together with his laboratory experiments at Maritzburg, three years later gave him the key to the problem. In spite of the successful demonstrations at Nels Rust, it was then stated that as dipping could not be carried out more frequently than fourteen days, and as the engorged tick which conveyed East Coast fever dropped off an infected animal within a few days, dipping was useless to stop the disease. But Watkins-Pitchford, like John Hunter, determined not merely to think but also to experiment. He did not assume that cattle could only be dipped once a fortnight, but set to work to find out how often, without injury, they might be dipped so

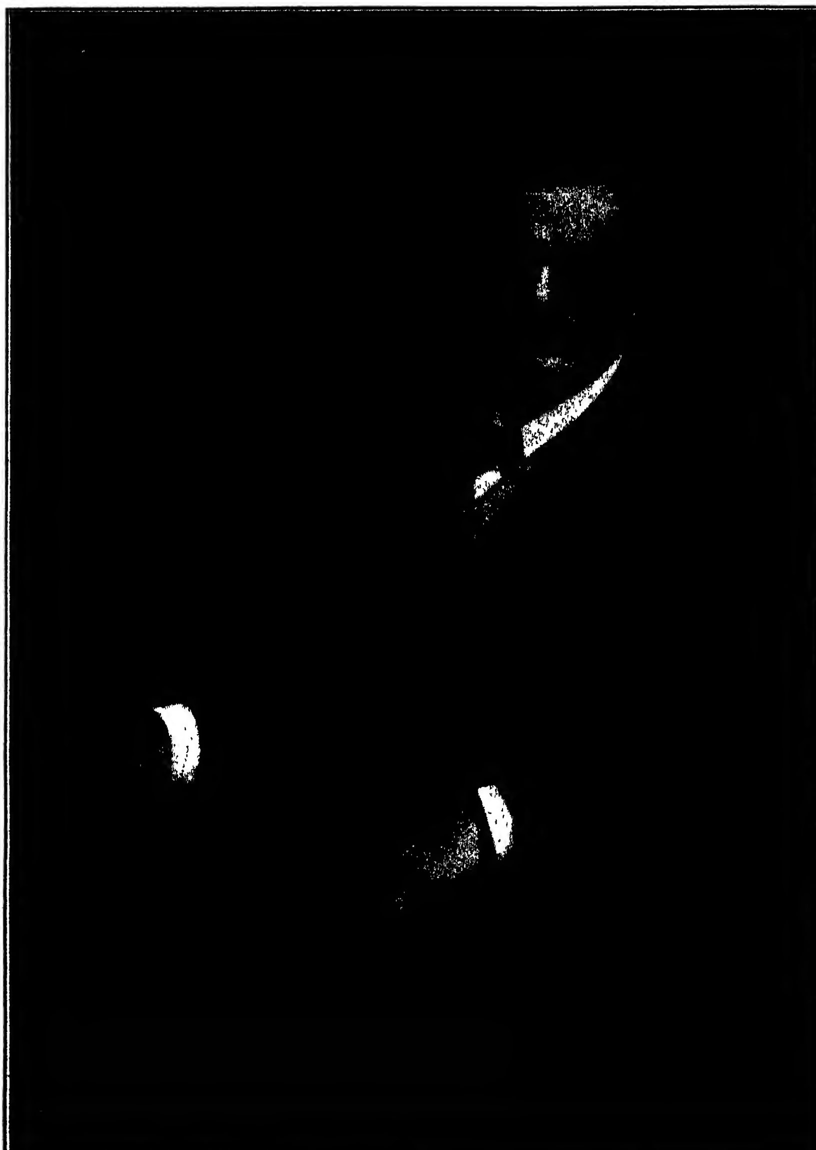


Plate No. 1.
The Hon. Joseph Baynes, C.M.G., Father of Dipping in South Africa.

as to destroy all the ticks. He proposed to discover the correct composition of the dipping fluid so as to secure (1) safety in use and (2) destructive effect. His first task was to test by practical experiment the action of all the best known dips on the market. Finding some of them injurious. and none entirely satisfactory when used at short intervals, he evolved the now well-known Laboratory dip, sometimes called the "Short-Interval" or "Three-day dip." This dip can be used every seventy-two hours with no ill effects to the animal, and with the complete destruction of all ticks. He further showed that with frequent dipping the skin of an animal becomes temporarily impregnated with arsenic so much as to render the beast poisonous to any ticks which may become attached to it during the intervals between the successive dippings. That is to say, a newly-dipped ox may destroy of its own accord a large number of ticks apart from those actually killed in the dipping tank. He proved that the three-day dip can be successfully used for sheep and horses and other animals as well as for cattle. And, lastly, he demonstrated that the disease can be carried by man, by sheep, in hay, and bedding, and that fencing alone does not prevent its spread.

Thinking for Humanity.

We have never had the pleasure of meeting this scientist, but no one can peruse his now classic experiments without being struck by his modesty, his industry, and his conspicuous ability. Every cattle-owner throughout the Union should procure a copy of his brochure, entitled "Tick Destruction and the Eradication of East Coast Fever and other South African Diseases by Dipping" (Messrs. P. Davis & Sons, Maritzburg, Natal). The history of the conquest of East Coast fever in Natal affords a pleasing illustration of unselfish co-operation amongst the three workers we have just mentioned, and forcibly reminds us of these arresting words spoken by a distinguished American scholar, Dr. Cyrus Northrop: "It is no longer one man thinking for himself alone that measures the progress of the race. It is rather multitudes of men thinking for humanity—all eager to share their thoughts and discoveries with one another and to publish them to the world."

Some years ago the dairymen of the Dominion of New Zealand presented a silver salver to the inventor of the Babcock Test in recognition of his splendid services to their industry, while the members of the Legislative Assembly of Wisconsin caused his name to be inscribed on their Parliamentary rolls as the man who had made their State the most famous milk region in the great Republic. But to our mind the eradication of the devastating tick is a far grander achievement than the invention of a test for butter fat. It is the custom of our Empire to honour those soldiers who have rendered conspicuous service to the nation by a vote of thanks passed in the Imperial Parliament. But Peace has her victories no less renowned than war; and we believe that the best reward which could be given to Baynes, Alexander, and Watkins-Pitchford would be a vote of thanks passed by the Union Parliament. Such public testimony would not only be a graceful tribute to the Province of Natal, but would plainly indicate that our legislators recognize the

Plate No. II.
Senator the Hon. Sir Liege Hulett, Kt., Founder of the Tea Industry of Natal.

priceless service that these citizens have rendered to the Union of South Africa. Be that as it may, we like to recall the words of the late Dr. Hutcheon, set down eight years ago in the following letter, which is worthy of permanent record in the pages of the *Agricultural Journal*:—

Natal Agricultural Union.

12 Timber Street, Pietermaritzburg,
October 28th, 1905.

The Honourable Joseph Baynes, M.L.C.,
Nels Rust.

Dear Sir,

I am directed by the Union to forward to you an expression of the feeling of the Inter-Colonial Agricultural Union, which met in Pietermaritzburg on Wednesday and Thursday last, regarding your successful work in dipping for the eradication of ticks.

The Inter-Colonial Agricultural Union fully discussed the question of dipping, and at the conclusion Doctor Hutcheon, Director of Agriculture at the Cape, moved a vote of thanks to you, coupling with your name that of Mr. G. D. Alexander, as being the first to introduce dipping into South Africa, on which account agriculturists owe you a deep debt of gratitude.

The vote of thanks was carried with acclamation, and I have very great pleasure in forwarding this expression of the Union's feelings in the matter by this letter.

I have the honour to be,
Yours faithfully,
DUNCAN M. EADIE,
Secretary.

What Dipping has done.

Before systematic dipping was started in Natal, had you gone through the cattle of Nels Rust, or indeed those of any other dairy farm, and examined their hair you would have seen myriads of tiny ticks so close together that it was almost impossible to touch the skin with a pin without touching a tick. Then the cattle were listless and emaciated, their hair ruffled, their ears bleeding. Then Nels Rust was one of the most horribly tick-infested spots in Natal. To-day you may wander amongst hundreds of cattle and you will find it a hard task to discover a single tick. The cattle are contented, sleek, and shiny. But the important thing is that in eradicating the tick the Natal farmer has not only eliminated East Coast fever and red-water, but a host of minor diseases such as hairball, ophthalmia, ring-worm, and mange. Before dipping the annual loss of calves was enormous, often over 60 per cent.; now it has sunk to under 5 per cent. Let us listen to Mr. Baynes on this matter:—"Before I began to dip I used to ask myself the question as I went amongst my cattle, 'Notwithstanding all your efforts to improve your herd and your costly importations are you making any headway? Don't you realize that your occupation is merely feeding ticks?' And but for the hope that sooner or later I would eradicate the tick I would have abandoned farming in this country years ago." At Nels Rust once a week all

Plate No. III. The Homestead at Nels Rust.

through the year every animal goes through the dip, with the exception of the merino sheep, which are dipped after clipping. Horses are dipped in the same way as the cattle. Mr. Baynes continued:—"At Nels Rust all the cattle of my natives, over a thousand head, are put through the dip every week. My natives are eager to dip their cattle without any form of compulsion, because they realize that by so doing they are safeguarding them from the disease. And I see no reason why all the cattle of all the natives in the Union of South Africa should not be dipped in like manner. By tactful handling and itinerant headmen to explain matters the Government could soon persuade the natives to dip their cattle, and so the disease would be eradicated from the native territories. By the simple process of dipping, millions of pounds sterling might have been saved to South Africa."

All through the ravages of East Coast fever out of a herd of 1300 at Nels Rust only five succumbed to the disease. It is no wonder that on this farm at least they have ceased to fear tick-borne diseases. Week after week the cattle are sent out to collect the ticks. Together they go into the dip. Unhappy ticks! Can anything be more simple?

Cheap Cows and Compulsory Dipping.

When Colonel Watkins-Pitchford first came to Natal he remarked to Mr. Alexander, "If I could give you a cure for horse-sickness or redwater which would you prefer? Without hesitation Mr. Alexander replied, "redwater." In the past the great obstacle to the agricultural progress of Natal has been the presence of redwater—the Texas fever of the United States and the tick fever of Australia. It meant that no farmer could import good stock from Europe with any hope of their surviving. And the result is that to-day you will hardly find throughout the length and breadth of the Province a high-class dairy or a first-class beef animal. Take, for example, a cow giving five gallons (or thirty bottles) of milk per day. You cannot buy that cow under £45. And so it happens that up till now very few dairy farmers have been able to breed cows capable of large milk production, since they do not possess the proper foundation stock. And, naturally, poor cows will continue to give a poor quality of milk. But where dipping has been sytematically carried out redwater has been virtually eliminated. Take a concrete example. Before taking to dipping Mr. Baynes imported thirty pedigree bulls from Great Britain at an average price of £124. Every one was dead a few weeks after arrival. Those bulls were most carefully cared for, yet in spite of daily attention they contracted the disease and died. The other day at Nels Rust we saw two valuable Lincoln Red Shorthorn bulls running freely and safely on the veld. Those virulent diseases, redwater and East Coast fever, are no longer feared there, and the same is true of many other farms in Natal.

Now, the rapid advance of the Australian dairy industry in recent years has been largely due to the goodness and the cheapness of the cows. A cow which costs £20 in South Africa could be bought for £8 in Australia. What the dairyman of Natal wants at the present moment is a good cheap cow and the enforcement of compulsory

Plate No. IV. A Paddock at Nels Rust.

dipping by the Government in order to clear the country of ticks. We visited Harden Heights. It is the centre of the wattle industry, but many farmers are now combining dairy farming with wattle growing. Nor is the reason far to seek. Wattle trees afford excellent shelter belts for the rich green pastures which lie between the plantations. Our genial host, Mr. W. J. S. Newmarch, bluntly stated that East Coast fever had been a blessing in disguise to Natal. "It has taught us," he said, "the lesson of keeping our animals free from ticks and vermin. The tick is to the cattle breeder what the scab insect is to the sheep breeder. Both can be easily eradicated." And so we were scarcely surprised when we came on a fine herd of imported South Devons grazing contentedly in a luxuriant paspalum paddock. For the weekly dip now makes possible the safe importation from England and Europe of valuable pedigree animals.

The Coast Country.

From Nels Rust and Harden Heights we journeyed to Kearsney. It is chiefly famous for the tea and the sugar industries, but for the present we have still something to say with regard to dairy farming. Mr. A. S. L. Hulett, who is a South African by birth, can speak with authority, and in his hospitable home we heard much of interest concerning the coast country. It is the opinion of the farmers of this part of Natal that the coast districts are destined to produce—in the near future—the richest cream and finest butter in the whole of South Africa. The main reason for this fact is that winter feeding is unnecessary owing to the abundance of green vegetation and the ease with which fodder, such as sugar cane, can be grown. At Kearsney we saw a patch of sugar cane, 5 acres in extent, planted ten years ago, which is cut every year to feed to cattle without any expense save one weeding per annum, which costs 6s. per acre. The cane is then put through a chaffcutter or shredder. The cattle thrive on this sweet fodder and keep fat all the year round. Moreover, grasses and all kinds of forage plants grow luxuriantly. The native guinea grass (ubabe) and the red encenda are excellent for milk production. Paspalum, sweet potatoes, and teosinte all grow splendidly. Formerly, on the coast, it was impossible to acclimatize pure-bred stock. Imported cattle used to die within a week. Since the year 1906, when systematic weekly dipping was started, the coastal farmers have cleared their farms of ticks and their cattle have increased marvellously. In the early days even the old Zulu cattle were so eaten up with ticks that they never gave any milk, and 80 per cent. of their calves died. Now the coast farmer saves more than 95 per cent. of his calves and is busy introducing pedigree Shorthorns, Ayrshires, and Frieslands.

To-day, the farmers on the coast are getting the highest prices for their cream at the Nels Rust dairy. Yet this cream is the product of cows of a poor quality. The cattle on the coast do not require shelter at all during the winter. They thrive better in the open. No barns are needed and no silos. Merely a dipping tank. Farmers send their cream to Nels Rust dairy from distances of over 100 miles. They are paid 18d. per lb. for butter fat, and the cream is conveyed to the factory free on rail by the company (Joseph Baynes, Ltd.). Here at least is an ideal land for small holders. People are just

Plate No. V. Cattle waiting for the Weekly Dip at Nel's Rust.

awakening to the potentialities of this wonderful country. In Zululand there is much beautiful land which, if cut up into blocks of 200 acres, would make splendid dairy farms. Along the coast good land can be bought at from £3 to £5 per acre within easy distance of the railway. Hear what Mr. Hulett has to say about the past, present, and future: "In the good old days that some people talk of we had to live on tin milk from Europe and butter from Australia. These were the days of imported produce. Then we fed ticks—not cattle. I shudder to think of the cruel sufferings of those poor bleeding animals in the good old transport days. They were literally coated with masses of ticks. East Coast fever swept the country for 200 miles from the Portuguese border to Umzimkulu. All our cattle were wiped out. We lost 400 head. Nowadays, dipping with us is merely so much routine work. We dip our animals every week on Saturday afternoon and let them rest on Sunday. They are so eager to get rid of the tiniest ticks that they rush in and plunge out again. The cost is infinitesimal. The dipping fluid lasts for four months. Our company have recently erected six dips. Dipping is worth millions of pounds to South Africa. I am absolutely and most emphatically in favour of compulsory dipping for two reasons: (1) It is humane; (2) it is profitable. The weakness of your Department of Agriculture is that it has not enforced compulsory dipping ere now. But the time must come, and shortly, when all patriotic farmers will unite to demand compulsory dipping for the sake of the welfare of the Union. I have been informed by Western Province farmers that they have no fear of tick fever because they have no ticks. It may be so; but the other day I attended a sale in Durban of cows introduced from the suburbs of Capetown, and I found them infested with ticks. Natal has saved the Union so far as East Coast fever is concerned, and the day is not far distant when she will insist that all cattle crossing her borders must be free of ticks." In the study of South African agriculture it is a remarkable fact that Natal has not only shown us how to eradicate the locust by means of the arsenical spray, but she has also taught us how to eradicate the tick by means of the arsenical dip.

Co-operation in Natal.

The more we come to study the rural conditions of Natal the more we are struck with the enterprise, the energy, and the intelligence of the farmers of this Province. Take, for instance, the extraordinary progress of the Agricultural Co-operative Union. It stands a splendid example of self-help and sturdy self-reliance—a society which scorns State aid. The name of the secretary, James Erskine Duff, seems to remind us of a Scottish Covenanter resurrected in the twentieth century to stir the dry bones of those colonists who live in this dream-like, lotus land. The Co-operative Union was started three years ago. It was formed by the amalgamation of the Wattle Bark Union and the Mealie Union. The membership is now over 900, and the annual turnover a quarter of a million sterling. To become a member the farmer must take up £5 shares either in one amount or at the rate of 10s. per annum spread over ten years. The idea is a limited liability company. The President of the Union is Sir Thomas Hyslop, and there are three committees—for wattles, for

mealies, for live stock. Take the matter of commercial manures, such as superphosphate, bonedust, basic slag, and mealie fertilizer, all of which are largely used in Natal. The secretary calls for tenders, say, 4000 tons per annum. Naturally, such a quantity can be bought at a much cheaper rate than a small amount by a single individual. At the commencement of the season superphosphate was sold at £4 per ton to the ordinary farmer, whereas the Union member only paid £3. 7s. 6d. per ton. The ordinary man pays 13s. to 14s. per bag of seed oats (150 lb.); the Union member can get it for 12s. 6d. Formerly the cost of arsenite of soda used for dipping was £3. 5s. per cwt. Through the efforts of this society it can now be purchased from the merchant at £1. 5s. per cwt. The terms of the Union are cash on delivery, but there is also a system called the credit association. This means that three or four members can club together and guarantee their own accounts, if approved by the committee, up to twelve months' credit at 8 per cent. interest. This is the buying side of the business. Now as to the selling. The Union has sold this year 60,000 bags of mealies for members at prices ranging from 10s. to 20s. per bag. The members are under no compulsion to buy or sell with the Union. But they realize that the Union saves them much time and trouble and obtains the highest prices. To the up-country farmer the Union is of special value. Take the case of wattle bark. The Union has agents in London and Hamburg, makes contracts, and ships direct. The other day a member received £1 per ton above the local market price in Durban. A form is sent out to all the members. They guarantee to supply a stated quantity of bark per month. With this knowledge the Union committee can watch the market and so secure the best price. The individual dealer in Durban does not know what quantity of bark he may have on hand month by month, and, consequently, he cannot offer as favourable terms. The Union also imports pedigree stock, purchases fencing material, publishes a weekly agricultural gazette which is issued free of charge to every member, and now proposes to insure live stock of every description. It is another illustration of the advantage of friendly co-operation in modern farming. The day of isolation, suspicion, and farm secrets is dead. The success of a nation is not measured by the fortunes of the few but by the prosperity of every citizen.

Tea and Coffee.

It is curious to observe how agricultural zones suddenly spring up in all young countries. South Africa is no exception to the rule: and so we find a wine zone in the Cape, a tobacco zone in the Transvaal, a wattle zone in Natal, and a sheep zone in the Free State. There are no hard and fast boundaries to these belts. They are often indefinable and are always advancing or receding. Perhaps the most strictly defined patch is the tea zone of Natal.

It was therefore with much pleasure that we spent a day last month in the company of Mr. A. S. L. Hulett on the famous Kearsney Tea Estate. Two days later, in Durban, we learned the early history of the introduction of tea into Natal from the lips of the founder of the industry, Sir J. Liege Hulett. Tea was grown in Natal as far back as 1850. In that year a certain Mr. Plant brought a few plants to Durban

from the Botanic Gardens at Kew. Several bushes were raised from this stock, and a few persons put an acre or two under tea. But no one ventured beyond these plot experiments. The next move was made in 1863 when Mr. J. Brickhill, of Umbilo, manufactured some tea which was not a success owing to the primitive mode of preparation. Fourteen years later, in 1877, Mr. J. L. Hulett (now Sir Liege) determined to try the experiment on a much larger scale. He was then President of the Lower Tugela Planters' Association and he formed a small syndicate to import seed from India. The seed was obtained by Mr. Brickhill, who imported two varieties from India; the Assam Indigenous from the Rookaug Estate and the Assam Hybrid from the Tonguburr Estate. The former was found to thrive best, and become the parent of most of the tea bushes in Natal. Sir Liege Hulett took over the largest amount of the Assam seed, from which he raised about 4000 plants. Unhappily, a severe drought destroyed many of the young plants. The remainder were carefully tended, and four years later bore seed from which the present tea estate was planted out. Since then the industry has made steady progress, and for many miles around Stanger tea estates can be seen. Natal tea has less tannin than any other tea in the world. It is therefore more healthful than Indian, Ceylon, or China tea.

It would appear that this industry has a great future. Unfortunately, at the present moment it is standing still, owing to lack of labour. The coolies are the natural tea pickers of the world. Their importation has been stopped and. consequently, no more land is being laid under tea. Yet Natal has thousands of acres upon which tea might be profitably grown. Faced with the insuperable difficulty of obtaining a constant supply of reliable labour the tea planter is now turning his attention to sugar cane, another, equally, or even more profitable industry. It is but natural that South Africans should wish to see the green hills, the luxuriant valleys, and the sun-washed shores of the Garden Province made glad with the toil of the white settler and the laughter of his children. But we must not forget that here we are dealing with the peculiar conditions of semi-tropical agriculture. And as we stood in the tea plantations of Stanger, and amidst the sugar canes of Mount Edgecombe, we thought of those words of the wisest of men: "*Get wisdom: and with all thy getting get understanding.*" It is well for us to realize the standpoint of the tea and sugar planter of Natal.

The progress of the rural industry of the Union depends upon the successful solution of the labour problem. In our recent studies in Natal we noted two things: (1) That the native (Zulu and Kaffir) is becoming a much more industrious and reliable worker than he has been in the past; and (2) that the use of machinery in both the tea and sugar industries is making a remarkable difference in the number of workers required.

It is true that so far as tea is concerned the "Flush" or the fresh green tops must be reaped at once or the whole crop is ruined. Consequently, the coolie trained to industry from the day of his birth is much better able to cope with this crop than the sun-loving Zulu. But if a machine can pick hops we see no reason why a machine should not pick tea. Certainly, in this field of invention there is ample scope for the genius of the European mechanic.

Let us sum up the situation. The importation of coolies has been stopped; the mines of the Rand are luring away the natives from Natal;

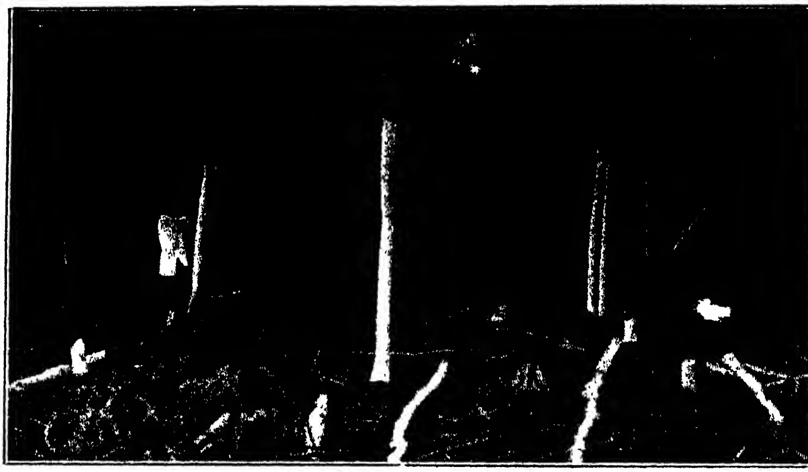
and there remains a terrible shortage of labour. To-day, you will find a handful of prosperous white men in the richest, undeveloped country in the Empire. For ourselves we can see but one safe and sound solution to this problem; and that is an immediate, sympathetic, and practical policy of land settlement. Let the people of this Province take as their ideal small farms of 200 acres worked by South African colonists and settlers from Oversea.

It was interesting to hear that the establishment of the tea industry was due to the failure of coffee. Let us listen to Mr. Alfred Hulett on this subject: "Here at Kearsney we cultivated coffee for seven years before we took to tea. But our coffee was wiped out by the well-known fungus which bears the scientific name of *Hemileia vastatrix*. In these days we grew the finest coffee in the world. It sold for £80 to £100 per ton and yielded one ton to the acre. About that time Mr. Fred Moir, of the Central African Lakes Company, came here to consult my father about coffee growing in Nyassaland. We advised him not to go in for it, and predicted that sooner or later the crop would be ravaged by the coffee leaf parasite. But he would not take our advice. Well, they had a few bumper crops, just as we had, and then they were wiped out by the disease as with a consuming fire. Curiously enough, about the same time the Ceylon coffee plantations were destroyed in like manner and they turned to tea exactly as we have done."

Mr. Hulett's reminiscences seem to us to be of more than passing interest. Next year a man will fly from England to America, a distance of 3000 miles, in thirty hours. That will be a wonderful triumph for the new science of aviation. But what of the old science of agriculture? Apparently, we dwell in a land which has been shown to be the grandest coffee country in the world. Are we to give up in despair because a miserable fungus calls for early coffee while we are slumbering on the stoep? It is surely not beyond the skill of a well-trained mycologist to eradicate this coffee pest. Suppose that the Government and the land companies interested in the development of Zululand and the Zoutpansberg (where coffee used to grow luxuriantly before the disease) were to put down, say, £3000 in order to discover a practical remedy for this plague, there is but little doubt that a cure would soon be forthcoming and that coffee growing would again be as profitable as it has been in the past.

Fresh Factors in Wattle growing.

In a recent number of the *Journal* we discussed the early history of wattle growing, and during our recent visit to Natal we took the opportunity of visiting the famous centre of the industry, namely, Harden Heights—an account of which we shall reserve for a subsequent issue. Meanwhile, we propose to speak briefly of those factors which progressive growers deem essential to the future success of the industry. For this information we are indebted to Mr. Duncan M. Eadie, the courteous and energetic secretary to the Natal Agricultural Union. During the past few years handsome profits have been made out of wattles, and as a result much more land has been placed under cultivation. Thus there has been a large increase in the output, but at the same time a fall in the price. It is stated, however, that the



Stripping Wattle Bark.

Plate No. VI.

Drying Wattle Bark at Harden Heights.

fall in the price of wattle bark is out of all proportion to the fall in the price of other tanning materials, probably caused by a change in the practice of tanning. Up till a few years ago raw bark was used in the tan pits. Nowadays, the tanner employs tannic acid in the form of a liquid extract from the raw material. Again, it is well known that wattle bark is sent chiefly to Germany and there turned into extract. This is a profitable enterprise for the German manufacturers owing to the fact that a heavy import duty is imposed on foreign extracts, whereas raw bark is admitted free of duty. But it does not seem feasible that wattle bark can be imported into countries except Germany and turned into extract at a price that will compete with other imported extracts unless there is a still further reduction in price in the country of origin, namely, Natal. To bear this reduction, and at the same time to ensure a market for this South African product, some radical changes in industrial practice must be made. These are the fresh factors of which we shall speak.

In the first place, there must be some improvement in the packing of wattle bark. In the past, wattle growers have been fortunate in having a freight rate of 25s. per ton of 2240 lb. between Durban and the chief European ports, that is to say, 27s. 3d. per long ton when port charges are added. With the completion of the last mail contract it was proposed to charge bark by cubic measurement. Under these new conditions a long ton of bark would cost 32s. as against 27s. 3d. as at present. This led to a protest on the part of the growers, but better still to a systematic inquiry as to whether wattle bark might not be pressed into rectangular packages instead of filling sacks as is done at present. This proved successful, and there is but little doubt that within a short time bark will be shipped at a rate equal to 15s. per long ton, or a saving of 12s. 3d. per ton.

The second factor to be considered in the new wattle industry is the manufacture in Maritzburg or Durban of wattle extract. Should the average price of bark fall below £5 per ton on the plantation, and this depression is maintained, a state of affairs may well arise which will render the manufacture of wattle extract more profitable than the export of raw bark. There seems no good reason why a wattle extract factory should not be erected in Natal which would prove as successful as the sugar factories now in operation. A third feature of the wattle industry is the disposal of the wood. A conservative estimate places the quantity of wattle timber annually available at a million tons. Owing to the hardness of the timber it is unsuitable for ordinary industrial purposes, and its small diameter debars it from being widely used as mine timber. A device for binding together the small trunks into a good sized pillar has recently been invented, and the resulting poles, after practical experiment in a Johannesburg gold mine are said to be quite efficient. But when all is said and done the present methods are wasteful to a shameful degree. It is to be hoped that wood distillation may be commenced in the near future with the object of producing acetate of lime as a main product and charcoal and tar as by-products. Summing up, we may say that the wattle industry has a great future. New conditions must be met by new methods. The wattle farmer of the future must be a world farmer.

Sugar-cane on hilly land in Natal.

Plate No VII.

Cultivating Sugar-cane at Mount Edgecombe

The Sugar Belt.

Twelve miles from Durban along the North Coast lies the picturesque estate of Mount Edgecombe, right in the heart of the sugar belt of Natal. It is something to be remembered when you stand here on a high hill and see around you, mile upon mile, the rustling yellow cane cut with tracks for wagon and tram, the tireless turbaned coolies, and far away a silver streak of sea. Mount Edgecombe comprises 17,000 acres of freehold and 3000 acres of leasehold. It is owned by the Natal Estates Company. Senator Marshall Campbell is the chairman and managing director, and to him we are indebted for much valuable information concerning the present status of the sugar industry. The early history of the sugar industry seems to be obscure, but it is said that Mr. Henry Morewood, of Compensation Flats, was the first to start growing sugar. He was soon followed by Messrs. Reynolds, Saunders, and Marshall Campbell, senior. The last-mentioned planter had been growing arrowroot—a most profitable crop—but the Natal output soon overstocked the London market, prices fell, and he turned to sugar-cane instead. This was in the year 1860. Since that time the industry has gone steadily onwards, and every day more and more land is being laid down to sugar. The annual production for the whole of the Province is now close on 100,000 tons, of a value of £13 per ton (or £1,300,000), which, with the by-products, bring up the total to one million and a half sterling, a sum happily circulated in the country. It is estimated that there are 65,000 acres under sugar cane in Natal at the present moment.

We like this sugar industry. There is something pleasing in the thought of filling the world with so much sweetness. The flat lands near the coast—alluvial deposits—make the best sugar lands. But all over the coast region of Natal and northwards into Zululand there are thousands and thousands of acres awaiting the plough and the planter. The finest sugar land, however, is in Zululand. It is all virgin land and is a little nearer to the tropics than Natal. Sugar does best with abundance of rain and plenty of heat. But Zululand, at the present moment, suffers from the disadvantage of distance. Some of the sugar cane is conveyed over 100 miles to the mills, and there is the risk of malarial fever at certain seasons of the year. Fever, however, is gradually being driven from South Africa by science and the simple life, which is nothing more than common sense and temperance, cultivation and drainage, paraffin, and the mosquito net.

Natal is not like other sugar countries. Her climate is only semi-tropical; and whereas in tropical regions the cane can be cut every year, in Natal the planter has to wait two years for his crop. The settler in seeking for good sugar land judges by the vegetation—the more luxuriant the better. In the early days of Natal all the country bordering the sea was covered with thick bush and rank grass, and in the more remote parts such primeval vegetation is still to be seen. In starting a plantation all this growth must be cleared away and burnt. The price of clearing land varies from 30s. to £6 per acre, according as the bush is heavy or light. The tops of the old canes are then taken and planted. The young plants sprout in about three weeks, and take two years to mature. In speaking about sugar,

Senator Marshall Campbell remarked, "You will doubtless be interested to know that we have had great success in applying the new methods of dry-farming to our cane growing. Whereas in the old days we could only hope to reap about 21 tons to the acre, now our average ranges from 26 to 30 tons. Dry-farming has been worth thousands of pounds to the sugar grower of Natal." It is usual to take three crops of sugar off the same land, but as many as twenty crops have been taken at Mount Edgecombe. If the planter does not replant his cane after three years it is liable to deteriorate and become infected with disease. Let us finish up with a little sum. Take 30 tons of sugar cane to the acre at 10s. per ton = £15. Allowing for the cost of cultivation and harvesting we may calculate that the planter will make from £5 to £10 per acre. At the Mount Edgecombe factory they formerly obtained 1¼ tons of actual sugar to the acre, but now by adopting dry-farming methods and up-to-date machinery they have increased the output to 3 tons of raw sugar per acre. It is worth mentioning that a short time ago £80,000 worth of old machinery was thrown on to the scrap heap.

The sugar industry offers a splendid opening for the small holder. Sir Liege Hulett & Sons have recently opened several new mills, and some two hundred planters supply their factories. These planters have been placed on Government farms varying in extent from 200 to 1000 acres. Such Crown lands have been eagerly taken up. Senator Campbell is a great believer in the driving power of poverty. He remarked:—"It is often said that men require capital to farm, but the people who have come out to Natal with little or no money have been the most successful. The most successful men under Hulett had very little money to start with. There are many men in Natal to-day who started with half a crown, and are now worth a hundred thousand pounds!"

This industry is destined to have a great future, and we are glad to be able to announce that Mr. H. J. Choles, Assistant Editor, who was born and brought up in the sugar country, will contribute a series of articles for the *Journal* touching the cultivation, manufacture, and economics of sugar.

Farmers of Forty Centuries.

Under this title there has recently been issued a work by the late Professor F. H. King, of Wisconsin. It is sad to think that this distinguished agricultural scientist has passed away ere he had penned the final pages of this volume. Now, before reading any book we like to look at the binding, scan the type, and study the illustrations. Most American textbooks are attractively bound, well printed, and beautifully illustrated. Such, however, is not the case with the volume under review. It was written by the third most eminent agriculturist in the United States, placing Bailey first and Hilgard second, and was well worthy of a handsome setting. We had hoped to see the skilled handicraft of the publishers of "The Soil," "Irrigation and Drainage," and the "Physics of Agriculture"—all books by Dr. King. But we looked in vain. Unhappily it has lately become the custom of certain American authors to publish their own works, with lamentable results. Cheap printing is always bad

Plate No VIII.

A Rainless Wheat.

The Durum Wheat—Apulia—grown on the Dry-land Station at Lichtenburg. No rain fell on this wheat from seedtime until harvest.

printing, in South Africa as well as in America. But our protest being made, let us now turn to more pleasing and important matters, namely, the contents of this volume. This book deals with the agricultural industry in China, Korea, and Japan. Professor L. H. Bailey, of Cornell, who writes the preface, points out that the first condition of farming is to maintain fertility—a matter which has been solved by the Oriental peoples. And the message of the East to the West is the message of the conservation of the natural resources of the land through centuries of time.

Here we have the plain unvarnished account of a virile race, now numbering 500,000,000 people, sustained on the same soil for forty centuries by labourers who work for a daily wage of 5 cents with food or 15 cents without. The soil of America is mainly virgin. The soil of China has been constantly cultivated for four thousand years. The magnificent results achieved by the ruralists of the Orient have been won by unresting industry, lavish fertilization, and strict economy. There is no waste of food, or feul, or fabric. Neither storm nor sunshine arrests the ardour of these industrious husbandmen. In the Shantung Province Professor King talked with a farmer having twelve of a family who kept a donkey and a cow (both used for ploughing) and two pigs on 2½ acres of cultivated land, on which were grown wheat and millet, sweet potatoes, and beans. This means a density of population equal to 3012 people, 356 donkeys, 356 cattle, and 512 swine per square mile (640 acres). These arresting figures may be compared with those of Kropotkin ("Fields, Factories, and Workshops"), who prophesied that under intense farming methods one square mile would support in comfort a thousand individuals. In China, one-sixth of an acre is ample for the maintenance of one person. In Japan, the average size of a farm is 2.5 acres. It is sufficient to keep one family very busy.

The Oriental farmer, like the farmer of South Africa, is troubled with dongas. But he has found a simple, practical remedy for soil erosion. His orchards are often laid out on steep slopes, the soil of which is liable to be washed away. To prevent this they are heavily mulched with straw to a depth of 6 to 8 inches. It is found that this practice effectively checks erosion by heavy rains. Moreover, in the mulberry orchards canal mud is used as a fertilizer at the rate of 70 to 100 tons per acre. Another, even more laborious, practice is the periodic interchange of soil. For example, the soil of a mulberry orchard is often transported to a rice field and vice versa. This change of surface soil has been found to greatly improve the succeeding crop. But the most amazing chapter in this instructive volume is that which tells of the collection, conservation, and utilization of all kinds of manures. Night-soil is sold at high prices by the municipalities to contractors and applied to enrich the land. To pour valuable sewage into the sea, as is so often done in England and America, would be considered nothing short of a serious crime. Peasants in China search for and collect the droppings of animals all along the country and caravan roads with the eagerness of a prospector in South Africa searching a river bed for diamonds. In the mulberry gardens the excretion of the silkworms, their cast-off skins, and chewed up leaves are buried in a circular trench around the trees to a depth of 6 to 8 inches. Actually all the waste is returned to the land save the silk produced from the leaves. This material all helps

in forcing the next crop of leaves. The Chinese farmer carries his primitive plough to and from his work every day. It was invented, so the historian tells us, by Shennung, the God of Agriculture and Medicine, who lived about 2737 B.C.

The Month and the Magazines.

Few farmers are able to spend the time, even if they have the opportunity, of perusing the numerous agricultural magazines which are now issued in the British Empire and the United States. Yet these magazines contain many items of interest and importance to those engaged in the agricultural industry. We propose, therefore, to make a few extracts, month by month, of what we think will prove of interest to our readers. A recent number of the *Farmer and Stockbreeder* contains the account of a cattle sale of more than usual interest. It was the annual sale of shorthorn calves from Mr. Duthie's well-known herd in Aberdeenshire. High prices were mainly due to the spirited bidding of the Argentine representatives. But the record price for a shorthorn bull calf, "Collynie Cupbearer," namely, 2000 guineas, was given by Mr. E. N. Casares, of London. The *Pacific Rural Press* announces that after many years of experimenting and the expenditure of a quarter of a million dollars, the E. Clements Horst Company have invented a successful hop-picking machine. This will be a great boon to the hop-farmers of California where reliable labour is so difficult to obtain and strikes are so frequent. It will also make possible the harvesting of large areas without the spotting and discoloration of the hops due to hand picking. The *Farmers' Advocate and Home Journal*, of Winnipeg, tells of the splendid progress of the "Million for Manitoba League." This league has been established to settle a million colonists in Manitoba. The Minister of Agriculture for Manitoba, the Hon. George Lawrence, is using all his influence to assist this great movement. The Publicity Department of the Canadian-Pacific Railway is distributing letters from satisfied farmers all over the Province. Advertisements of Manitoba have been inserted in 7000 papers throughout Great Britain and the United States, while six representative farmers, on behalf of the league, visited fourteen agricultural fairs in the United States. South Africa possesses a far grander agricultural country than Manitoba. Why should not we adopt similar methods to attract a virile population to our vacant lands? In the *North British Agriculturist* we read of the development fund and its distribution. During the next five years (1911-15) the Commissioners have decided to spend the following sums: For harbours, £450,000; for forestry, £350,000; for agricultural co-operation, £50,000; for horse-breeding, £250,000; for rural industries, £70,000; for agricultural research and education, including grants for buildings, £900,000; for other purposes, up to £230,000; total, £2,300,000. In the same periodical we read of a college croft. That is to say, the Aberdeen Agricultural College has taken over a croft in a certain district of Ross-shire with the object of demonstrating to the crofters of the neighbourhood how much can be made by proper methods of farming. This experimental croft is proving a great success and is being visited by numbers of people. In our

evidence before the Small Holdings Commission in Pretoria we advocated the establishment of an experimental small holding for the purpose of demonstrating the agricultural potentialities of acre farms, and we are pleased to note that to the county of Ross in our native land belongs the credit of this movement. In the *Agricultural Gazette* of New South Wales Mr. J. E. O'Grady writes of the tobacco-growing industry, with special reference to the White Australia Policy. It would seem that most of the tobacco now raised in New South Wales is grown by Chinamen, who consider weight rather than quality, and, consequently, produce an inferior leaf. To our readers it will come as a surprise that the author of this article has to advocate tobacco growing as a crop eminently suited to the white man. But the few white men in New South Wales who have taken it up have easily surpassed the Chinamen, and get higher prices for their tobacco. A sheep shearer, Mr. C. W. Gilson, says that this industry is very suitable for two partners. They might work 8 acres of ground, renting it at £2 per acre with house found. The returns from 8 acres might be taken as 4 tons of No. 1 bright, which, at 1s. per lb., will amount to £446. He recommends tobacco growing for men engaged in hard manual labour and for those who wish to retire. In South Africa tobacco culture offers a profitable field for the small holder. Turkish tobacco has given as much as £100 per acre in the Cape, and a Rustenburg farmer on 3 morgen of dry land (6 acres approximately) made £300 clear profit last season. In the *Journal of the New Zealand Department of Agriculture* Mr. A. Macpherson tells of the reclamation of the sand dunes around Christchurch. Some years ago the sand hills were sown with seeds of leguminous plants, li pines, gorse, and broom. These crops were ploughed in and lucerne seed then sown. It has proved a great success, and these once sterile areas are now being pastured by dairy farmers. For green manuring the lupin has no superior. *The Journal of the National Poultry Organization* points out that some people seem to be so fond of eggs that they keep them until they are more or less unfit for human food. In other words, a stale egg is very dangerous. A French scientist, Laroquette, has demonstrated that germs penetrate through the pores of the shell and set up putrefaction inside the egg. We all know a new laid egg. We all know a bad egg. But eggs in the various stages from freshness to decay are more difficult to determine, and, unfortunately, hundreds of such eggs are annually sold to the unhappy townsfolk of the Union of South Africa. *American Forestry* has a most interesting illustrated article on "A Working Erosion Model for Schools," by Don Carlos Ellis. This model consists of two hills sloping down into two valleys through which two streams wind in and out through farm land and lead into two lakes in the front of the landscape. One hill is forested; the other is bare. By means of a sprinkler rain falls with equal force upon the two hills. It falls gently on the tree-planted, moss-covered surface, but on the unprotected barren hill it rushes down, carrying soil and stones to the valley below. This, or a similar model, should be placed in every farm school throughout the length and breadth of South Africa.

Veterinary Research.

In the opening pages of the *Journal* we have spoken of the eradication of the tick by dipping, but we cannot close without a few

words relative to the work in pure research which must ever be regarded as the foundation of all real progress in Agricultural Science. Dr. Theiler, the Director of the Veterinary Research Laboratory, has been a constant and valued contributor to the *Agricultural Journal* during the past ten years. He is now on leave in Europe pursuing his much-loved studies with unresting ardour. His place for the time being has been taken by Mr. William Robertson, who has lately been appointed Assistant Director of Veterinary Research. On behalf of our readers we welcome Dr. Theiler's distinguished colleague. Mr. Robertson was born in Kelso, Scotland, in the year 1872, and was educated at the University College School and the Royal Veterinary College, London, and the Institut Pasteur, France. For two years he was Assistant Bacteriologist at the Jenner Institute of Preventive Medicine under Lister and Roscoe, and for six years Veterinary Assistant at the Colonial Bacteriological Institute, Grahamstown. In 1902 he was appointed Director of the Veterinary Research Laboratory at Grahamstown, which appointment he held until he was transferred to Pretoria. Mr. Robertson has seen much service both in the laboratory and in the field. He began his professional career in this country under one of the greatest of veterinarians, the late Dr. Hutcheon, a man whose meritorious service to South Africa has never been sufficiently recognized. In 1897 Mr. Robertson acted as Dr. Robert Koch's assistant at the Kimberley Compound when the German bacteriologist discovered the preventive method of bile inoculation for rinderpest. A little later he was dispatched to Basutoland, where he inoculated 150,000 head of cattle for rinderpest. It is worthy of note that South Africa is the only country in the world where the disease of rinderpest has been arrested and eradicated without the necessity of the wholesale destruction of cattle, that is to say, without resorting to the stamping-out policy. It is lamentable to think that so little progress had been made in British veterinary science that the precepts of Professor Gamgee, who advocated the killing of all infected and incontact animals to stamp out rinderpest, should have been taught by the leading veterinarians of England sixty years later. But South Africa broke away from those trammelling traditions, adopted the bile treatment, and so solved the problem of rinderpest.

In 1900 Mr. Robertson collaborated with Mr. C. E. Gray, then the Principal Veterinary Surgeon for Rhodesia, in fighting East Coast fever. It was Mr. Gray who, in the early days, fought rinderpest in Rhodesia single-handed and carried the campaign to a successful close. As most of our readers are aware, Mr. Gray succeeded Sir Stewart Stockman, M.R.C.V.S., as Principal Veterinary Surgeon of the Transvaal, and now holds the same office in the wider sphere of the Union. To Mr. Gray is due the credit of introducing the mallein treatment for glanders into Rhodesia, while his new Contagious Diseases Act is a model to the veterinary world. As his friends say of him, his excellence in the office is only surpassed by his activity in the field. His assistants, Mr. Borthwick and Mr. Christy, have both had an extensive practice in the control and eradication of the diseases of live stock. Such is a small portion of the veterinary staff now at the service of the farmers of the Union, and we venture to remark that both for profound research and practical work in the field it is unrivalled by any similar branch in the British Empire.

The work of the Division of Veterinary Research consists in the investigation of animal diseases and the preparation of various vaccines. Last year over 5000 blood-smears from East Coast fever areas were examined and reported upon. The number of vaccines issued for the year ended 31st December, 1912, was as follows:—Mallein, 4000 doses; blackwater (sponziekte), 182,000; anthrax, 15,000; redwater, 3000; gall-sickness, 2000; and antivenene, 300; as well as 589,000 tubes of vaccine lymph for the prevention of smallpox. Dr. Theiler's name will always be associated with the discovery of a practical method of immunizing horses and mules against horsesickness. These animals can now be protected against this disease with a very small percentage of loss. During the past year over 2000 mules were inoculated, and by a system of graduated payments the animals can now be insured against loss. Much additional work is being done in African diseases at the Onderstepoort Laboratories, Pretoria, and also at several of the out-stations in different parts of the Union, while the special facilities for research in parasitology offered by the Bacteriological Institute are attracting veterinary students from all parts of the world.

Teff (*Eragrostis abyssinica*).

By JOSEPH BURTT-DAVY, F.L.S., F.R.G.S., Government Agrostologist and Botanist.

OWING to the wonderful success which has attended the introduction of teff into the Transvaal, and its value as winter feed for stock, it is desirable that the attention of farmers in the other South African Provinces should be drawn to it.

The chief value of teff as a hay crop lies in its palatability, high nutritive value, narrow albuminoid ratio (for a grass-hay), heavy yield, rapid growth, drought resistance, and ability to smother weeds. Our experience with teff in the Transvaal is that if sown in October (provided we have fairly good rains to establish the braird), we can obtain a cutting of about a ton of hay per acre by the first week of the New Year; at this time we often have ten days to two weeks free from rain, which allows farmers to harvest the crop nicely. Our steady rains usually begin about the middle of January; these induce the teff to start fresh growth, which continues till the dry weather begins in March; by this time another hay crop of 1 to 1½ tons per acre can be cut and cured. Light showers usually occur in March, enabling the teff crop to make an after-math which furnishes good pasturage until it is killed by frost. If weather, etc., do not permit us to sow in October we can sow through January and still secure a good crop.

HISTORICAL.

Teff was first introduced into the civilized world as an agricultural crop by the Royal Botanic Gardens, Kew, which imported the seed from Abyssinia in 1886 and distributed it to various botanic gardens and other institutions in India and the Colonies, including Natal. The primary object of the introduction of this grass was to relieve a famine in India, it being a very quick-growing, drought-resistant crop, the seed of which is ground into flour and made into bread by the natives of Abyssinia.

As a result of this distribution the following reports were received :—

British Guiana.—It was reported to make "an excellent fine hay" and to mature in six or eight weeks from the time of sowing. "For this purpose teff is well worth cultivating. It is cleaner and brighter looking than any other grass, and is readily eaten by cattle and horses" (8).

India.—In 1887 seed was given to the Rajah of Jashpore, and was reported upon favourably: "The straw or grass is 4 or 4½ feet in length and smells sweet. The hill people have taken a fancy to the crop" (6). Mr. J. F. Duthie, F.L.S., wrote (7): "I have a bad opinion of it as a food-grain, but think better of it as a fodder."

Sown in March, the crop was cut in the beginning of May, but sprang up again into a second growth and yielded a cutting of green fodder early in the rains. Sown in July (the rainy season) and cut in the middle of August, the green crop weighed 16,000 lb., or from 2000 to 3000 lb. of dried hay per acre. At a hill station (Arnigadh) "the hay made from the teff was of exceptionally good quality and was greedily eaten by the garden bullocks. When it was offered to them they were being fed upon jowar (i.e. kaffir corn) or sorghum stalks, and, as is well known, these are remarkably sweet, and cattle, when fed upon them, generally refuse other kinds of dry food until they find that the sorghum is not forthcoming. Our garden cattle, however, seemed to prefer the teff-hay to sorghum, as they would not touch the latter until they had devoured the whole of the teff placed before them! The experience gained here during the last year in the cultivation of teff may therefore be summed up as follows:—When sown in the dry season it will yield a light crop of grain, and when sown in the rains it yields little or no grain, but produces abundance of green fodder, which may be cured into very palatable hay where the latter is preferred. In my opinion teff is destined to become the *ryegrass of India*, and is well worthy of more extended trial on some of the Government fodder reserves (16).

Australia.—The reports were equally favourable, the value of this plant for fodder purposes being considered exceptionally high. Its chief merits in this respect are the short time it takes to mature and its suitability to thrive in dry, sandy regions where few other grasses would flourish equally well (8).

Natal.—Mr. J. Medley Wood, A.L.S., Director of the Natal Botanic Garden, Durban, reported in 1887 (4) as follows: "I received from the Director of the Kew Gardens a small bag of seeds of this plant, which is used in Abyssinia for making bread. The seed is very small, and it appeared to me that it would scarcely find favour in Natal as a cereal, though possibly in some parts of the Colony it might be found useful as a fodder plant. I therefore, after having the seed tested, and finding it quite good, distributed it in small packets to persons willing to give it a trial, and hope in a future report to be able to record the results." In 1888 he wrote (5): "This will, as I suspected, have no value as a cereal in Natal, but very favourable reports have been received of it as a quick-growing fodder-grass." Again, in 1889 (15): "It was highly thought of as a quickly growing grass, though as a cereal it proves, as I had suspected, to have no value in Natal. Whether or no the recipients of the seed have thought it of sufficient value to continue its cultivation, I have no information. De Schonburgk says that it stands drought well, and is a good grazing grass."

CAUSES OF FAILURE AS A GRAIN CROP.

As a drought-resisting *grain crop* for relieving a famine in India, the introduction of teff does not appear to have been a success. This result and the details contained in the above reports suggest the possibility that the teff introduced was the variety known as *Thaf-Tseddia*, the *quick-growing*, rainy season sort, described by the missionary Colbeaux (3) as "of very inferior quality, and the flabby cake, or the 'tabita,' which is produced from its flour, is as disagreeable to chew as if it were mixed with sand." The slow-growing, or

The Teff-plant (*Eragrostis abyssinica*).

Thaf-Hagaiz variety, is described by the same writer as requiring nearly five months, or two months longer than the other, and as being of superior quality for human food; "its flour is only advantageously used in making 'tabita,' a kind of large fermented pancake. The 'tabita' of Thaf is most easily digestible and has none of the bitterness of some other kinds of grain."

But its failure as a grain crop for India may be due entirely to other factors. The yields of grain where it was tried appear to have been usually too small to be profitable. It should be borne in mind, moreover, that in the work of seed and plant introduction and acclimatization, success rarely follows first attempts, whereas perseverance, repetition, study of controlling conditions, and removal of inhibiting factors often result in subsequent success. The natural conservatism of native races should also be taken into account. A further cause of failure may have been the lack of a well-organized system of co-operation in field experiments on private farms. Observation and experience show that to overcome indifference or conservatism it is not sufficient to maintain demonstration plots on Government farms or experiment stations, nor to issue publications broadcast, nor even to "stump the country" lecturing to farmers. New crops are generally taken up first by theorists or men trying to "get rich quick," to whom the advertisements of novelties in the seed catalogues appeal; such men are often poor farmers, and thus make a failure of what otherwise would be a success, the result being that the new crop gets a bad name.

Had we not adopted a system of co-operative experiments with the Transvaal farmers, by which selected farmers *who knew how to grow crops* were induced to try new and promising things under supervision, teff would not to-day have been the success that it is. In spite of the favourable reports quoted above, it does not appear to have become established either in Australia or India. As already noted, it was introduced into Natal in 1887, and was distributed among twenty farmers, seventeen in Natal, two in Zululand, and one in the Transvaal; though it was reported in 1888 as being "highly thought of as a quickly growing grass," it failed to acquire the status of a farm crop, and it was not until after I had reintroduced it in 1903, and by carefully fostering it, that it became established. But as Mr. Wentworth Sykes has pointed out (11), "it has now certainly come to stay, as witness the hundreds of tons of hay sold locally last year (1910) on the Johannesburg and Pretoria markets, which is but a tithe of that sold or fed locally."

SUCCESS AS A HAY CROP.

In an anonymous article (8) on tropical fodder grasses it is stated (p. 375) that "in dry regions not suitable for permanent pastures, the Abyssinian teff (*Eragrostis abyssinica*) might be grown during the occasional rains and made into hay. This grass will produce a heavy crop of hay in six weeks from the time of sowing. It is very nourishing, and cattle are very fond of it."

About this time Kew very kindly sent me a little seed to California, where I grew it at the experiment station of the College of Agriculture. I was at once impressed with the wealth of hay produced.

But California is a region of winter rains where lucerne thrives to perfection, and where lucerne is, therefore, the staple forage crop.

No one who could grow lucerne cared anything about putting in an *annual* hay crop like teff, and lucerne being in the ascendant, no farmer had room or time for teff.

INTRODUCTION INTO THE TRANSVAAL.

When I came to the Transvaal in 1903 I brought with me seeds of the most successful grasses which I had grown at the experiment station there, such as teff and New Zealand tall fescue (*Festuca arundinacea*). Most of these did well, and from the start teff was a great success. In my Annual Report for the season 1903-04, dated 26th October, 1904, I wrote (9):—

"Teff (*Eragrostis abyssinica*) is an annual grass of Abyssinia, leafy and fine in quality, and 2 to 4 feet high, seeding heavily; it makes very rapid growth, maturing in seven or eight weeks from time of sowing, and if cut before the seed develops, a second crop can be obtained from the same stand; it makes an excellent catch-crop for hay, two successive cuttings being obtainable during the summer on un-irrigated land. The plants seed heavily, our yield of seed from a small plot having been at the rate of about three-quarters of a ton (1500 lb.) per acre; the seedlings are not readily scorched by the intense heat of summer, which is a most important point in this climate; its adaptability to our conditions is shown by the way in which 'volunteer' seedlings came up all over our 'experiment grounds' under the most adverse conditions. Stock eat this grass readily, both green and when made into hay. Teff is a most promising plant for further experiment. . . . Seed is now offered by French dealers at about 3s. 2d. per lb.; it weighs about 63 lb. per bushel."

Seed harvested from this crop was distributed among selected farmers in different districts of the Transvaal for trial under ordinary farm conditions and to test its adaptability to different parts of the country. My system was to issue the seed free of all cost to the farmer, who signed a written undertaking to return to me from his crop twice the amount of seed supplied. In the case of failure of his crop this condition was not enforced. The majority of bona fide farmers loyally carried out their agreement, and where they desired to retain all the seed for further experiment, they often offered to pay cash for it.

In my Report for 1904-05 (p. 248) I wrote:—"Mr. V. L. Robertson, of Amersfoort, reports: 'In this grass [teff] I think we have struck the desired hay for the high veld; sown 6th November it was 3 feet high in February and ready for cutting for hay; if cut then, it would have matured for a second crop of hay in April. Its yield of hay per acre must be tremendous. On account of the soft, thin straw, it dries and cures very quickly. Of all my experiments this has pleased me more than any.'

"The general consensus of opinion is that teff is a most valuable hay-grass. Under favourable conditions it will mature in two months from seed; the seed scatters easily and freely, readily producing a volunteer crop. The yield of seed is remarkably heavy [rendering it cheap and easily obtainable]. The fact that the farmers appreciate the crop is practically illustrated by the requests received for permission to retain, and pay cash for, teff seed which is due to the Department as a return for the seed originally supplied."

In February, 1905, my then assistant, Mr. Hugh C. Sampson, B.Sc., writing in the *Transvaal Agricultural Journal* (Vol. III,

p. 547), noted that teff sown at the Botanical Experiment Station on 26th November, 1904, was cut for seed on 20th February, twelve weeks from sowing, and gave a yield of 10,285 lb. of green forage per acre, having had only 7.12 inches of rain during the growing period. "Though it has only been cut two days, the roots are already starting new growth for a second cutting."

In my Report for 1905-06 (p. 112) I noted that "out of twenty-two reported co-operative trials all but two were unqualified successes, and the failures were due to locusts and hail; farmers cannot speak too highly of this crop. One of them writes: 'This can no longer be looked upon as an experiment; its success is assured.' The consequent demand for seed is greater than the supply, owing to the fact that nowhere else than in Abyssinia has this become a commercial crop. By next season, however, I expect that all difficulty in this direction will have been overcome as so much ground is being sown-down to teff this year."

In my Report for 1906-07 (p. 175) my then assistant, Mr. H. Godfrey Mundy, reported that out of twenty-eight co-operative experiments, carried out in all parts of the Transvaal, twenty-one were entirely successful, in one case a yield of 4 *tons of hay per acre* being reported. It was also highly spoken of, in several cases, as a smother-crop for weeds. A progressive farmer in the Wakkerstroom District wrote: "It is a grand stand-by at the end of the winter, and I don't expect to be without it in future. All stock are fond of it and do well on it if cut before the straw gets strong. I am now selling seed." From the Ermelo District a farmer wrote: "I have grown teff most successfully and have supplied farmers round about me with over 100 lb. of seed free."

During this period the demand for seed always exceeded the supply, and the price ranged from 1s. up to 5s. per lb. With increased production this fell to 9d., 7d., 6d., 5d., and, finally, 4d. During 1911 I had offers of seed from farmers which totalled over 100,000 lb., and this year (1912) one farmer alone has produced 60,000 lb., which he is selling at 4d. per lb. in 100-lb. lots, or 5d. retail.

DIFFICULTY IN SECURING A MARKET FOR THE HAY.

But although teff took with the progressive Transvaal farmer from the start, the hay did not become a commercial article till some years later. As is usually the case with new farm crops, teff-hay did not sell well when first offered. But it was first grown for farm consumption, and only the surplus crop was put on the Johannesburg market. I well remember how disappointed I was at the reports of the earlier sales; they brought no more than ordinary rough veld bedding, and were in fact bought for the same purpose! But that was only because the townsman did not know anything about the new hay. Steps were taken to have trial lots tested by large consumers, but to move a market requires either the whole-time energies of a shrewd business man or some fortuitous accident. I had other things to do and could not act as Trades Commissioner for the introduction of teff-hay on to the Johannesburg market! But the accident happened. As far as I can learn the details, they were as follows:—

A farmer having more teff-hay than he required for the consumption of his stock, decided to sell the surplus, and sent it to the Johannesburg market. As stated above, it did not sell well; none of

the buyers knew the stuff, and it finally went for bedding. This was disappointing, and I, personally, was afraid it might check the spread of the new crop. But I need not have been afraid. Evidently the low price paid the grower, for it was only his surplus, and his own use of the bulk of the crop doubtless paid him well, leaving the surplus for extra profit. He, and others, continued to send small lots, which were also bought for bedding. As bedding, teff is softer than the ordinary bedding cut from vlei sedges and *Arundinella Ecklonis*, and one lot was therefore selected by the buyer for a racing stable, as being superior to the ordinary. Rumour has it that the owner of the stable found that his racers ate their bedding in preference to the hay in their racks! Being an observant man, and realizing that the price he had paid for the "bedding" was much lower than that of lucerne hay or oat forage, he decided to buy more and feed it. To his surprise (the story goes) his horses not only ate all the teff-hay, but began to put on condition; then he bought up all that was put on the market and called for more. Others soon got wind of this, and the price rose. It was not long before it had risen from 1s. per bale, or £1 per ton, till it commanded the same price as lucerne hay, i.e. 7s. 6d. per 100 lb., or £7. 10s. per colonial ton.

Once a market was established, the production went up by leaps and bounds; the markets were soon flooded and the price fell to a normal figure; but by this time farmers had learned the value of teff-hay for consumption on their own farms, and when it did not pay to rail it to market they fed it. Two years ago I never expected to again see teff reach a high figure, but the unprecedented drought of the winter of 1912, following a season in which the rainfall (in Pretoria) was 7 inches below the average, has raised the price of hay and fodder so that teff has again been selling at £7. 10s. per ton in Johannesburg.

Since Union I have distributed teff seed to the other Provinces, and am glad to find that it is taking hold in the Orange Free State, Natal, and the Eastern Province. A good deal of seed has been sold by Transvaal farmers to Rhodesia, and some to Nyassaland, British East Africa, German South-West Africa, the Congo State, and Portuguese East Africa, so there is reason to expect that teff will, ere long, become a staple hay-crop throughout civilized Africa.

FEEDING VALUE.

Analyses of teff-hay made by Herbert Ingle, F.I.C., late Chief Chemist of the Transvaal Department of Agriculture, show (14) that teff-hay has as well-balanced an albuminoid ratio as oat-hay. The following comparison is made from the figures supplied in Mr. Ingle's report:—

	Teff-hay. A.	Teff-hay. B.	Oat-hay.	Boer Manna. A.	Boer Manna. B.	Lucerne Hay.
Moisture	8·88	9·16	8·00	8·25	6·54	7·97
Ash	5·55	6·71	4·23	7·78	6·06	8·94
Protein	6·21	4·72	5·65	5·00	4·90	15·49
Soluble Carbohydrates	39·08	42·71	44·01	46·24	38·93	30·58
Ether Extract	1·21	1·07	3·87	1·88	1·07	2·36
Crude Fibre	39·07	35·63	34·22	30·85	42·50	34·76
	100·00	100·00	100·00	100·00	100·00	100·00

	Teff-hay. A.	Teff-hay. B.	Oat-hay.	Boer Manna. A.	Boer Manna. B.	Lucerne Hay.
Albuminoid ratio—						
Conventional	1:68	1: 9·6	1: 9·4	1:10·1	1: 8·5	1:2·3
Suggested	1:12·8	1:16·8	1:14·5	1:15·8	1:16·8	1:4·4
The Ash included—						
Silica	3·25	4·08	2·01	5·67	2·44	0·49
Potash	1·28	1·62	—	—	2·30	3·61
Lime	0·30	0·27	0·18	0·30	0·21	1·38
Phosphorus Pentoxide ...	0·24	0·28	0·34	0·32	0·09	0·32
Ratio of Lime to 100 Phosphorus Pentoxide ...	125	96	53	94	217	431

The grain of teff (red) has been analyzed by Professor A. H. Church, M.A., F.C.S. (3), whose report is as follows:—

	In 100 *parts.*
Water	15.2
Albuminoids	8.2
Starch, etc....	68.1
Oil	2.8
Cellulose, etc.	2.8
Ash	2.9
	100.0

"The ratio between the albuminoids, or flesh formers, and the heat givers, or force producers (calculated as starch), is here 1: 9. This ratio is less satisfactory than that of the majority of millets, but is near that of *Panicum miliare* (common or broom-corn millet)."

PREPARATION OF THE GROUND.

Teff requires a very fine seed-bed, fully as fine as the best prepared lucerne land, for the seed is extremely small and, if buried beneath large lumps of soil, it cannot germinate. Although teff makes an admirable smother-crop for weeds, if it can get the start of them, it is not successful in this direction if the weeds are allowed to come up first.

SOWING.

The seed being very fine, it is customary to mix it with twenty times its bulk of sand or sandy loam; it may then be sown with a "fiddle" or other broadcasting implement, or drilled in with a grass drill. The seed should be sown practically on the surface—in fact, it is often harrowed in—or it may be sown broadcast behind the harrow. It is important that a thorough harrowing should be given at the time of sowing to kill any weed seeds that may be germinating then; if seeds of such weeds as mestbredie (*Amarantus paniculatus* and *A. Thunbergii*) and stinkblad (*Datura*) get a start of the teff seedling, they will keep ahead of it, but if the teff gets the start of the weeds it will smother them, giving them no chance to get light and air; a week, or even four or five days, between harrowing and sowing the teff may be enough to give the weeds the start.

A crop can be grown by sowing 2 lb. of seed per acre; some sow 4 lb., but the usual sowing is about 7 lb., and 10 lb. is better if the lands are weedy and it is desired to produce a thick smother-crop.

Teff (*Eragrostis abyssinica*).

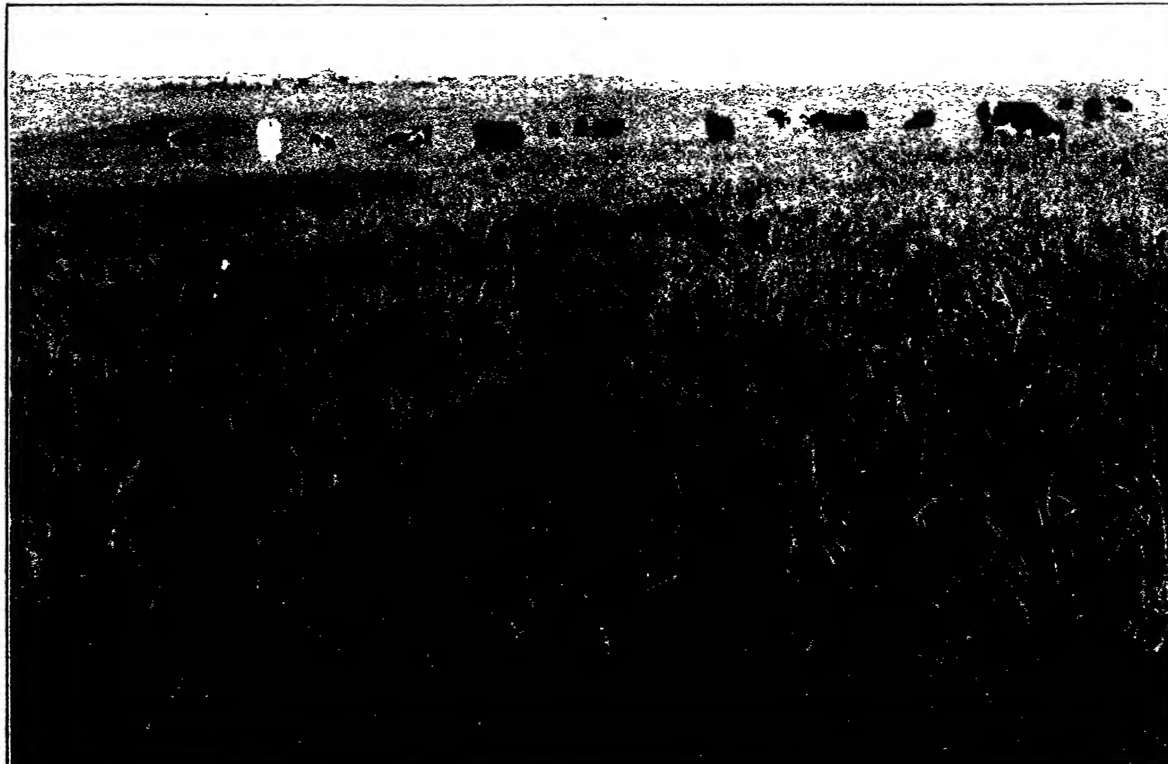


Plate No. IX.

Witbank Colliery Farm. Teff Grass, second grazing. Government seed sown on old mealie lands after three crops. Land poor red sandy soil. Splendid results. Cattle and horses do particularly well on this grass. Photo. taken 15th February, 1908.

TIME OF SOWING.

The teff seedlings being delicate may be burned off in a ten-day drought if they have not become well established. In choosing the time for sowing, therefore, it is well to avoid those months when a drought is almost sure to occur. In Pretoria we prefer the middle to end of October for the first sowing and the early part of January for the second. It is also desirable to arrange the sowing so that the crop will not be ready for cutting during the normal period of heaviest rains; in Pretoria this is from the middle of January till the end of February; as the summer growth takes about two months, it is usually undesirable (with us) to sow between the middle of November and the end of December. In seasons like the present, when the rains are erratic, one sows teff when there is sufficient moisture to bring it up, taking chances on a dry spell, for, after all, the seed is cheap and quickly sown.

PREPARATION OF THE CROP.

Teff is primarily a hay-crop. Being fine in stem and leaf it dries quickly, and must not be left long exposed to the sun. It is too fine to make good silage, and as it is so easily turned into hay it would be a waste to ensile it (unless the weather remained too continuously wet to make hay), for good hay is always considered better than good silage. Teff being fine, it bales well into compact heavy bales.

It may be ploughed under as a green-manure crop to advantage, for though it is not a leguminose nitrogen-gatherer, it will add a lot of humus to a "burned out" soil if ploughed in while green.

All stock like it and do well on it. We have tried it for ostriches with success.

Teff has raised scores of small Transvaal farmers from poverty to comparative comfort, and has been largely instrumental in putting the dairy industry of the Witwatersrand on its feet. The opinion has been expressed by our farmers that "if the Division of Botany of the Department of Agriculture had done nothing else, the introduction and establishment of teff as a farm-crop would have more than paid South Africa the whole cost of the Division for the ten years of its existence."

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The Establishment and Cultivation of a Vineyard.

By Dr. A. I. Perold, Government Viticulturist.

Since recently I repeatedly received letters from different parts of the Union asking for detailed information on the establishment and cultivation of vineyards, and since it is impossible to give the desired information in a letter, I wish to give the necessary information by means of this article.

This can best be done by answering the following questions:—

1. Where can I establish a vineyard?
2. How must I prepare the soil?
3. Which varieties of grapes should I grow?
4. On which stocks must they be grafted?
5. When and how must I plant the vines?
6. How must I cultivate my vineyard soil?
7. How must I treat the vine itself?

In the first place, then—

1.—Where can I Establish a Vineyard?

The vine grows over a very extended area. But as it is practically always cultivated for the production of grapes, be it for wine or table grapes, the above question really means: "Where can I establish a vineyard with fairly good prospects of obtaining a good and regular crop?" In this form the question is by far not so vague as at first. The three main factors that should be taken into consideration are climate, site, and soil.

Since the young shoots, etc., of the vine are very much affected by frost, viticulture is and remains a dangerous and uncertain undertaking in districts where practically every spring one may expect frosts. Therefore viticulture is most remunerative in those parts where a temperate climate prevails. As soon as the climate becomes sub-tropical, as in the coast districts of Natal, the vine grows so vigorously that it produces an unsatisfactory crop and lots of wood. Should, moreover, much rain fall during the summer months, then the grapes easily rot during the process of ripening. Hence the most favourable climate for viticulture is a wet winter, mild spring with occasional rains in the early part of summer, followed by a dry summer and autumn. All these circumstances are best realized in the south-western districts of the Cape Province, where viticulture on a large scale has been in existence for a long time. Viticulture, as an agricultural pursuit, will therefore in future remain established in these parts. This, however, does not do away with the fact that one can also have small vineyards in the interior of the country for one's pleasure and personal use where rains, sometimes accompanied by

hailstorms, are prevalent during the summer months. Should the crop in this case be destroyed, it does not mean a serious loss to the farmer.

The site of a vineyard is a matter of great importance. Generally, one may say that a northerly site is the best. This means a gentle slope which is so situated that the rays of the midday sun stand almost perpendicular to the surface of the vineyard soil. Since the sun stands in the north at noon in these southerly parts, the slope must necessarily have a northerly site. Then it is also a very good thing if the first rays of the morning sun can fall on the vineyard. This must, on the whole, be considered as the most ideal site. One is frequently, however, forced to depart from this rule. For instance, it may be that the best vineyard soil is situated otherwise, or that a vineyard on such a site will suffer too much from frosts and strong winds. When selecting the site for one's vineyard, one should take all circumstances into consideration. The *nature of the soil* is here of the utmost importance. It is, for instance, wiser to establish one's vineyard in a fertile, cool soil than in a shallow, poor soil that sometimes gets too wet and then, again, too dry. Sometimes the surplus water in the soil can be got rid of by draining (see my pamphlet on "Drainage"). Where the mean rainfall in a year is not less than 20 inches, no summer irrigation should be necessary if a suitable cultivation of the soil is adopted. Very poor, sandy soils require much manure in order to produce good vintages, whilst very fertile soils frequently cause such a luxuriant growth that the vines grow too vigorously and produce either too little grapes or produce grapes of an inferior quality. Fairly fertile, deep, cool soils are the most suitable for viticulture. We shall see later on that the different varieties of grapes answer better in certain soils than in others.

2.—HOW MUST I PREPARE THE SOIL?

On soils which already bore vines, one should generally first grow other crops (cereals, vegetables, potatoes, etc.) before again planting them with vines. On virgin soils poor in vegetable matter (humus) one should first grow cereals or vegetables or potatoes for some years. A good preparation of the soil at the beginning prevents many disappointments afterwards. In case of deep, loose (sandy) alluvial soils, deep ploughing may frequently suffice. In the south-westerly coast districts of the Cape Province most vineyard soils must be trenched from 24-30 inches deep. One has, of course, to trench in the right manner. Where the sub-soil is a heavy clay, this must not be brought to the surface but only loosened in the furrow by means of a fork. One should not trench before the soil is moist enough, and, at the same time, dry enough. In case the soil is too dry, the work proceeds but slowly and is very hard, whilst too wet a soil is just as unsuitable, since it adheres to the spades and the trenched soil is then not loose enough and not sufficiently aerated. One should always try to make the soil as level as possible, as this facilitates the planting of the vineyard and the later cultivation to a great extent. Under all circumstances one should provide for appropriate drainage by putting down drainage pipes or by other means. It is also desirable to leave the soil lying for about one month before planting it to give it a chance to settle. Instead of trenching one can plough the soil and then loosen it by exploding dynamite cartridges in the soil after

having planted the vines, or the other way round. Only since quite recently has dynamite been used in this country for the above purpose. So far, the results have nearly always been very satisfactory.

3.—WHICH VARIETIES OF GRAPES MUST I PLANT?

In the first place one must decide whether wine or table grapes are to be grown. Further, it should be decided what kind or kinds of wine one intends to make—whether table grapes for export or for local consumption, or for raisins, are to be grown. We shall treat the last case first.

Table Grapes.

Soil, climate, as well as *site* are also here of the utmost importance. Early varieties of grapes should only be grown where they are *really early,* as, taken as such, they are by far not of the same quality as those ripening only slightly later. Their value lies in the fact that they are *the first.* If they are really early then they are well paid for. Generally, they do not bear as much as the later varieties. The late varieties can only be cultivated where they are *really late* and where they can remain on the vine for a long time without rotting. Therefore no late can be grown where rains are to be feared at that time of the year.

Some of the best table varieties are mentioned in the following list, approximately in the order in which they ripen. The asterisk indicates that they are suitable for export.

Grapes for Raisins.—Almunecar, Hanepoot, Currant (black and white), Sultanina.

Early White Table Varieties.—Madeleine Angevine, Précoce de Malingre, Précoce de Courtiller, Agostenga, Madeleine Royale.

Early Black Table Varieties.—Gamay hâtif Dormoy (Gamay hâtif des Vosges), Noir hâtif de Marseille, Black Prince.

White Table Varieties for Main Season.—White Muscadel, Chasselas doré de Fontainebleau, Foster's White Seedling, Sultanina (Sult. blanc), *Dattier de Beyrouth, Cornichon Blanc, Muscat Cannon Hall, *Muscat d'Alexandrie (Hanepoot), *Raisin Blanc, *Waltham Cross, Crystal Grape.

Red and Rose Coloured Table Varieties for Main Season.—Red Muscadel, *Karroo Belle, Grec Rouge, *Laubscher's Gem, *Molinera Gorda, Sultanina Rose, *Red Hanepoot, Flame-coloured Tokai.

Black Table Varieties for Main Season.—Muscat Hamburgh, Black Hamburgh, *Cinsant, *Hermitage, Frankenthal, *Lady Downe's Seedling, Gros Maroc, *Black Spanish (Black Alicante), *Tribodo Nero, *Grossa Vivarais, *Bonnet de Retord.

Late Varieties.—(*a*) *White*: *Olivette Blanche, *Servan Blanc, *Ohanez (Almeria grape). (*b*) *Rose-coloured*: Olivette Rose, Sabalkanskoï. (*c*) *Black*: *Barbarossa, *Gros Colman (Dodrelabi), *Henab Turki, *Barlinka, Malakoff Isjum (Olivette Noir), Danugue (Gros Guillaume), Prune de Cazouls.

Wine Grapes.

Here one must first make out what kinds of wine can be produced with the greatest success under the given conditions of climate, soil, and site. As a rule, one will in most cases be able to make different kinds of wine on the same farm. One should, however, try to make principally a type of wine for which the circumstances are specially favourable.

One may distinguish between red and white wines. These, again, can be classed under the following types:—

Red Wines.—Port, red sweet wines, Burgundies, Clarets (Médoc or Bordeaux wines), other red wines, such as Chianti, Hermitage, etc.

White Wines.—Marsala, Madeira, Sherry, white sweet wines (Sauternes, etc.), Rhine wines, Chablis (white Burgundy wines), Hock (Moselle wines).

Although it is possible to make more or less the same type of wine from different varieties of grapes and different wines from the same variety of grape, I still wish here to quote the principal varieties of grapes from which the above-mentioned kinds of wine are made.

Port.—So far, Muscadel and Pontac are more or less the basis of our best Port wines. Undoubtedly Hermitage and other varieties are also used. In the Douro valley (above Oporto) where the genuine Port wines are produced, one finds from 10-20 different varieties of grapes in one and the same vineyard. The principal varieties are: Alvarelhão, Tinto Cão, Mourisco Tinto (and Mourisco de Semente or Albino de Souza), Tinta Francisca, Malvasia Rey, Malvasia Preta, Tinta Roriz, Codega, Touriga, Bastardo de Menudo (and Bastardo de Castello), Red Muscadel, Formosa.

Red Sweet Wines.—They are made mainly from Muscadel and Muscat de Frontignan.

Burgundies.—The best Burgundies are made from the Pinot Noir (or Pinot Fin). The wines of inferior quality are mainly made from Petit Gamay or Petit Noir. In this country the Burgundies are principally made by blending Hermitage, Cabernet Sauvignon, and Pontac. They are frequently slightly fortified.

Clarets.—The genuine Clarets or Médoc wines are made from Cabernet Sauvignon with a much smaller quantity of Cabernet Franc, Verdot Malbec, and Merlot. In this country the Clarets are made from Cabernet Sauvignon with Hermitage, and, sometimes in addition, Malbec, Schiraz, and a few other varieties.

Chianti.—That famous Tuscan wine is made from Sangioveto Chianti, Giano, and Trebbiano Fiorentino.

Marsala (Sicily) is mainly made from Catarratto and Inzolia.

Madeira.—The principal varieties here are Verdelho de Madère, Sercial de Madère and Boal, of which the first one is the most important.

Sherry.—The principal varieties from which the Sherries at Jérez (or Xeres) in southern Spain are made are: Palomino (Listan), Mantuo de Pilas, Mantuo Castellano, Albillo Castellano (Arvillo), Pedro Jimenez (Pedro Ximenes).

Sauternes, etc.—The Sauternes wines are mainly made from Sauvignon Blanc and Sémillon. Further different Muscat varieties are used for white sweet wines.

Rhine Wines.—These are mainly made from the Riesling grape. For inferior Rhine wines the Oesterreicher or Sylvaner is cultivated.

Chablis.—This famous wine of Burgundy is made from Pinot Chardonnay.

Hock (Moselle Wines).—The genuine and by far the best "Hocks" are those from the Moselle. They are made from Riesling (Moselle or small Riesling). In this country the Hocks are mainly made from Greengrape, White French, and Stein.

NOTE.—With only a few exceptions, canes of the above-mentioned varieties can be obtained from the Government Oenological Station,

Paarl. Applications should in time be sent to the Government Viticulturist, Paarl.

4.—ON WHICH STOCKS MUST THEY BE GRAFTED?

Generally, I refer the reader to the Report of the American Stocks Commission, which was published in the July and August numbers of the *Union Agricultural Journal*, 1912.

It should not be forgotten that the soil in any case must be suitable for the stock in order that it may be able to develop well to resist phylloxera, drought, etc., sufficiently. Hence one must, in cases of varieties which may be grafted on almost any stock, choose that stock which is most suitable for one's soil and climate. I shall first give a list of the above-mentioned varieties which cause no special trouble as far as the grafting is concerned and which therefore can be grafted on almost any American stock, provided the soil is suitable for the graft-bearer. After the names of the varieties I add here and there the names of such American stocks that are especially suitable for those varieties. After this I shall give a list of those varieties which can only be grafted on certain American stocks, and at last a list of those varieties of which it cannot yet be said with certainty on which stocks they ought to be grafted.

A.—Varieties of Grapes which may be grafted on most American Stocks.

Red and White Muscadel (Rup. du Lot, Aramon Rup. Jacquez, etc.).

Black Prince.

Cornichon (Aramon Rup., Rup. du Lot, Jacquez, etc.).

Dattier de Beyrouth (Jacquez, Rup. du Lot, 101-14).

Foster's White Seedling (on vigorous growers, such as Aramon Rup., Jacquez, etc.).

Molinera Gorda (Rip. Gloire, Rup. du Lot, etc.).

Sultanina (white).

Muscat Hamburgh.

Cinsaut (106-8, 125-1, 3309, Rup. du Lot, Aramon Rup. No. 2).

Hermitage.

Frankenthal.

Olivette Blanche.

Servan Blanc.

Olivette Rose.

Sabalkanskoï (Rip. Gloire and Rip. hybrids).

White and Black Currant.

Henab Turki (Rip. Gloire, etc.).

Malakoff Isjum or Olivette Noir (Jacquez, etc.).

Danugue.

Pinot Noir (Rip. Gloire, etc.).

Petit Gamay (Rip. Gloire, etc.).

Merlot (Aramon Rup., 3306, 3309, etc.).

Malbec.

Schiraz.

Sercial (Rip. Gloire, Rup. du Lot, etc.).

Boal (Rip. Gloire, Rup. du Lot, etc.).

Sauvignon Blanc (Rip. Gloire, etc.).

Pinot Chardonnay, White and Red Greengrape, Stein, White French, Kanaan.

B.—Varieties of Grapes which must only be grafted on certain American Stocks.

Ohanez (the Almeria grape), on Aramon Rup., Jacquez, Rup. du Lot, 420A.

Lady Downe's Seedling, on Aramon Rup. No. 2, Rip. Gloire, 101-14, Rup. du Lot.

Black Alicante (Bl. Spanish), on Rup. du Lot, 3306, Aramon Rup.

Red and White Hanepoot, on Jacquez, Rip. Gloire, and probably also Rup. du Lot, 1202, 3306, 101-14, 420A.

Gamay Hâtif Dormoy (G. h. des Vosges), on Aramon Rup. No. 1, 1202, Rip. Gloire, 3309, Rup. du Lot, 1616.

Noir Hâtif de Marseille, on Aramon Rup., 1202, Rup. du Lot, 3306, 3309, 101-14.

Chasselas doré de Fontainebleau, on Aramon Rup. No. 1, 1202, 3306, 3309, Rip. Gloire.

Muscat Cannon Hall, on Rip. Gloire.

Gros Colman (Dodrelabi), on Aramon Rup., 3306, 3309, 101-14

Tinta Francisca, on Rip. Gloire, Rup. du Lot, 3309.

Cabernet Sauvignon, on Rupestris hybrids.

Sangioveto Chiantigiano, on Rip. Gloire.

Trebbiano Fiorentino, on Rip. Gloire, Aramon Rup. No. 1, 1202, Jacquez.

Catarratto and Inzolia Bianca, both on Rup. du Lot, Rip. Gloire, 41B, Aramon Rup. No. 1.

NOTE.—For these two varieties Aramon Rup. No. 2, 1202, and 101-14 are absolutely worthless. *One should observe that Aramon Rup. No. 1 is very suitable here, whilst Aramon Rup. No. 2 is absolutely worthless.*

Verdelho de Madère, on Rip. Gloire, Rup. du Lot, Aramon Rup. No. 1, 3309.

Sémillon, on Rup. du Lot and Rupestris hybrids.

Precoce de Malingre, on Rup. du Lot, 1202, Aramon Rup.

Precoce de Courtiller, on Rip. Gloire, 420A, 157-11.

C.—For the following varieties the stocks cannot as yet be given with certainty. (After the names of the varieties the American stocks are quoted which for the present seem to be the most suitable.)

Tribodo Nero, Grossa Vivarais, Gros Maroc.

Raisin Blanc (Rip. Gloire, 420A, Jacquez, Constantia Metallica).

Waltham Cross (Aramon Rup., Jacquez, Constantia Metallica).

Crystal (Jacquez, Aramon Rup.).

Karroo Belle, Grec Rouge, Flame-coloured Tokai, Barbarossa, Barlinka, Prune de Cazouls, Alvarelhão, Tinto Cão, Mourisco Tinto, Mourisco de Semente or Albino de Souza, Tinta Roriz, Malvasia Rey, Malvasia Preta, Codega, Bastardo de Menudo, Bastardo de Castello, Formosa, Touriga, Palomino or Listan, Mantuo de Pilas, Mantuo Castellano, Albillo Castellano.

Pedro Jimenes (Jacquez, Aramon Rup.).

Riesling (Aramon Rup., Jacquez, Constantia Metallica).

Madeleine Angevine, Agostenga, Madeleine Royale.

Pontac.

NOTE.—By "Aramon Rup." is meant Aramon Rup. Ganzin No. 1 and No. 2; in all other cases Aramon Rup. (Ganzin) No. 1 or No. 2 is clearly stated as the case may be. It is, of course, not to

be inferred that the varieties given under *C* cause trouble when being grafted. I could only not find any particulars about them on this point. Most of them can probably be grafted successfully on Jacquez and Rip. Gloire (very probably also on 420A and Aramon Rup.).

5.—WHEN AND HOW MUST I PLANT THE VINES.

Where, as in the south-westerly districts of the Cape Province, most rain falls during the winter months, one must plant your vines towards the end of winter or at the beginning of spring. Should late rains fall, one may safely plant still later. Further, one can plant earlier on dry, warm sites than where the soil remains cold and wet for a long time. The best time to plant out the vines here is generally between the 15th August and the 15th September. When planting, the soil should be sufficiently dry. Some rain after planting does a lot of good. One should have the vines ready some time before they must be planted. During this time the vines should be laid in loosely, care being taken not to put them too close together. This should be done in a fairly dry place, and the vines must be altogether covered with soil in order to prevent them from drying out or from budding too early. The grafted vine should be given one spur (not more) of two eyes. Their roots, mainly the thicker ones, should be cut off near to the stem.

The important question now to decide is, *how far to plant the vines from each other and in which directions the rows should run.* The answer to the first half of this question is that the vines must at least be planted so far apart that the vineyard can be easily and properly cultivated and that the vineyard does not suffer from drought in summer. Taking into consideration that the question of labour is always getting more serious, one is almost everywhere obliged to plant your vineyard so that it can easily be cultivated by machinery. For this purpose the distance between the rows must be at least 4 feet. If the soil is poor, the vines must be planted further apart than in very fertile soil. In very rich soils (f.i. in the Montagu District), which can in addition be irrigated in summer, the vines can sometimes be planted very close to each other (in Montagu mostly 3 feet 4 inches × 3 feet 4 inches). The working expenses are here somewhat high, as everything has to be done by hand, but the exceptionally high production more than warrants it. In this case the vineyard is also planted so close in order to prevent as much as possible the rays of the sun from reaching the soil, thus lessening the evaporation of the water in the soil and thereby at the same time diminishing the danger of the much-feared "brack." For a wine of a high quality the vines ought not to be too big and too vigorous, hence varieties for wine may be planted closer than table varieties.

Where one cannot or does not want to irrigate the vineyard during summer, the main question remains: How far must I plant the vines so that they do not suffer from drought during summer? Even when the soil was trenched deep enough and is kept loose by suitable surface-cultivation, one will frequently find that a patch of vines which is planted 6 feet × 6 feet (on a hill) produces better and more grapes per morgen of vines than a patch alongside of it which is planted at a distance of only 4 feet 6 inches × 4 feet 6 inches or 5 feet × 5 feet. In fairly cool, sufficiently deep soil one may plant your vineyard 4 feet 6 inches × 4 feet 6 inches or 5 feet × 5 feet

square. Along slopes or on hills the vines ought to be planted so that the vineyard can be ploughed more or less in a horizontal direction along the slope. In this case, and in any case, I prefer the "quincunx" system of planting to the planting of vines in squares. Where the slope is very steep one sometimes does best to plant the vines "schuinsrij-uit" (diagonal), as then the diagonal rows are less steep and therefore better for ploughing than in the "quincunx" system.

Figures 1, 2, and 3 illustrate the planting in squares, in "quincunx," and "schuinrij-uit," respectively.

From the figures it can be clearly seen how to plant the vines. However, to be still clearer, I shall here give a short description of the three methods mentioned above.

(1) *The Planting in Squares (Figure 1).*

At first one has to mark the side row ABC. Then two rows at the top and bottom ends are marked at right angles to the first side row. This is done in the following manner: Starting at the corner

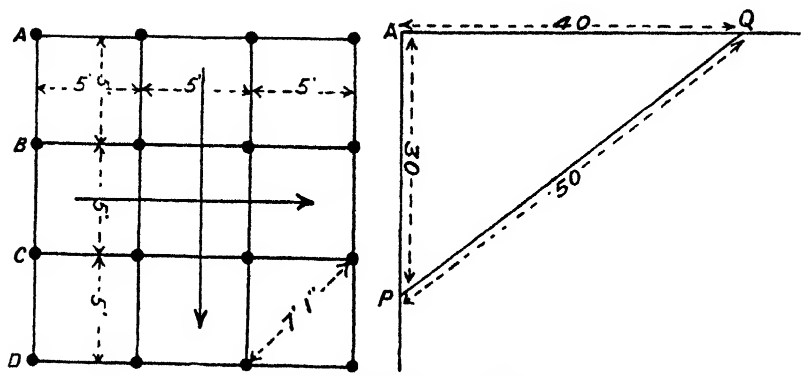


Fig. 1. Planting in squares.

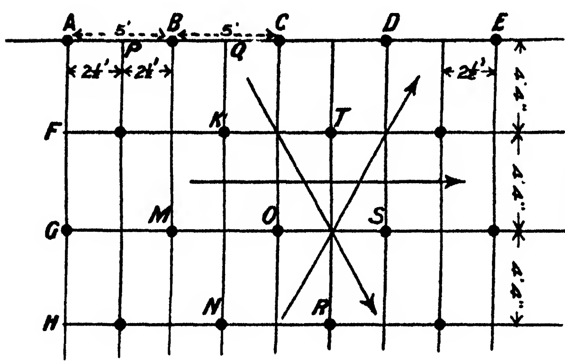
A one measures, say, 30 yards in the direction of the side row ABC to point P. Then a rope of 40 yards and another of 50 yards are required. The end of the former is kept at A and that of the latter at P (30 yards in the side row from A). Now both ropes are pulled straight and taut, and where they meet a peg is placed. We now have a triangle whose sides AP (the first side row), AQ (the sought side row), and PQ are 30, 40, and 50 yards long, respectively. Then AQ is the side row which is at right angles to the first side row AP. This is so whether one measures 30, 40, and 50 yards, or so many feet. One may measure other distances, so long as the sides AP, AQ, PQ are in ratio, 3 : 4 : 5, to each other. Thus, instead of 30, 40, 50 yards one can take 15, 20, and 25 or 60, 80, and 100 yards. Now the side row AQ is simply marked further in the same direction to the other end of the land. At the other end of the first side row AP one marks in the same way as above the third side row at right angles to the first. If one now measures from the top and the bottom ends of the first side row exactly the same distance along the top and bottom side rows respectively, and if two pegs are here driven into the soil, then the distance between these two pegs must be exactly the same as the length of the first side row, that is to say, if the work

was performed accurately. No notice need be taken of a small difference (under ½ per cent.). Should the difference be greater, the work has to be repeated to find out where the mistake was made.

Once the four side rows are marked and found correct, a measure (tape-line, etc.) is placed in the top and bottom side rows respectively, and shallow furrows are made with spades across the land. If it is intended, f.i., to plant the vines 5 feet square, then these furrows are made at a distance of 5 feet. When the furrows are thus made, the measures are placed in the other two side rows and the line is spanned across the land. Everywhere where the line intersects the furrows a stick is planted. The rows are, of course, now also planted at a distance of 5 feet from each other.

According to this method the following number of vines go to a morgen (of 100 yards × 100 yards):—

At 4 feet 6 inches × 4 feet 6 inches...	4444
,, 5 feet × 5 feet	3600
,, 5 feet 6 inches × 5 feet 6 inches...	2975
,, 6 feet × 6 feet	2500



AB=BC=CD=5'.
AF=FG=GH=4' 4".
AP=PB=BQ=2' 6".
OK=OM=ON=OR=OS=OT =5'.

Fig. 2.—Planting in "Quincunx."

(2) *The Planting in " Quincunx."*

Here, too, at first four side rows at right angles to each other have to be marked all round the ground. If one intends planting your vineyard at 5 feet in "quincunx," then the shallow furrows are made at 4 feet 4 inches apart. Having done this, one plants a stick in the side row at every alternate furrow. Now the line is spanned across the land at a distance of 2 feet 6 inches from the side row and the vines are planted where the line intersects the furrows which were omitted before. One can, of course, just as well make the furrows at 2 feet 6 inches distance and span the line every 4 feet 4 inches, as the other way round. In each case one plants alternately in the one furrow and then, again, in the other. On slopes one should mark one side row more or less in a horizontal direction along the slope and not against the slope. This is necessary to be able to plough horizontally along the slope and thus prevent as much as possible any washing away of soil during winter. If the vineyard is thus planted then there are always six vines which are 5 feet distant from the vine in their midst and six which are 8 feet 8 inches distant. If the vineyard is planted 5 feet square then there are always only four vines

which are 5 feet distant from the central vine and four which are 7 feet 1 inch distant. This proves clearly that by adopting the quincunx system a better distribution of the vines over the ground is obtained than by planting in squares. I consider 5 feet "quincunx" as a very good distance in most cases. For those who want to plant wider or narrower I shall give the necessary distances. At the same time I shall state the number of vines necessary per morgen (100 yards × 100 yards) for each distance.

Distance in the row.	Distance between the rows.	Number of vines per morgen of vineyard.
4 ft. 6 in.	3 ft. 10¾ in.	5133
4 ft. 9 in.	4 ft. 1⅜ in.	4608
5 ft.	4 ft. 4 in.	4153
5 ft. 6 in.	4 ft. 9 in.	3445
5 ft. 9 in.	4 ft. 11¾ in.	3143
6 ft.	5 ft. 2⅜ in.	2887

If the distance in the row is multiplied by 0.866, then the width of the row which can be ploughed is found. It can also be clearly

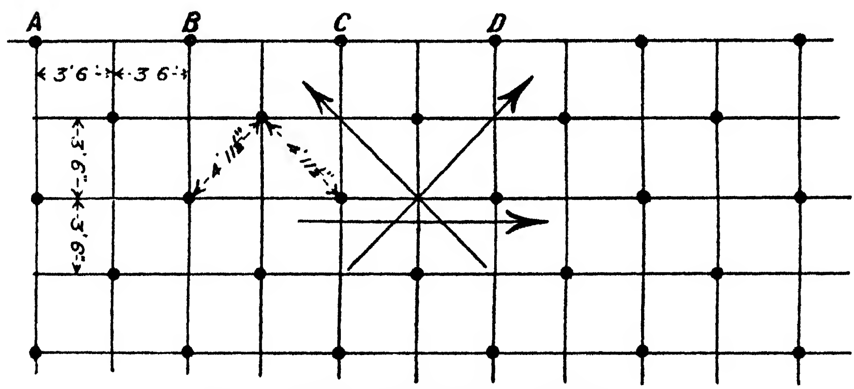


Fig. 3. Planting "Schuinsrij-uit" (Diagonal).

seen from Figure 3 that there are three equally wide rows if the vineyard is planted in "quincunx." This is one of the greatest advantages which is got when the vines are planted according to this method. In Figures 1 and 2 the rows which one can plough are indicated by arrows. It will be observed that in Figure 1 only two different equally wide rows are suitable for cultivation. The diagonal rows soon become too narrow for ploughing in case the vineyard is planted in squares. It should be noted that the furrows must be made from each other only at half the distance of the vines in the row.

(3) *The Planting "Schuinsrij-uit" (Diagonal).*

Here the work has to be started in exactly the same manner as when adopting the square system. If the vineyard f.i. is to be planted 3 feet 6 inches "schuinsrij-uit" then the furrows are at a distance of 3 feet 6 inches from each other, and the line is spanned across the furrows according to the same measure. Then a stick is

planted at every alternate furrow. In the following row the vines are planted in those furrows which were omitted in the previous row.

This is perfectly clear from Figure 3. If the vines are planted 3 feet 6 inches "schuinsrij-uit" then the diagonal rows are, so to say, 5 feet wide (exactly 4 feet 11½ inches).

In the following table those measures in the different systems are placed next to each other which require approximately the same number of vines per morgen:—

Square.		Quincunx.		"Schuinsrij-uit."	
Measures.	Vines per morgen.	Measures.	Vines per morgen.	Measures.	Vines per morgen.
4 ft.	5625	4 ft. 3 in.	5775	2 ft. 10 in.	5625
4 ft. 6 in.	4444	4 ft. 9 in.	4608	3 ft. 2 in.	4500
4 ft. 9 in.	3988	5 ft.	4153	3 ft. 4 in.	4051
5 ft.	3600	5 ft. 6 in.	3445	3 ft. 6 in.	3674
5 ft. 6 in.	2975	5 ft. 9 in.	3143	3 ft. 10 in.	3062
5 ft. 9 in.	2722	6 ft.	2887	4 ft.	2813
6 ft.	2500	6 ft. 6 in.	2460	4 ft. 3 in.	2500

When planting, a hole is made at the desired spot by means of a spade by treading it deep enough into the soil and then bending the soil open with it. In this opening the vine is put at first deeper than it should remain standing. Now it is slowly pulled in an upward direction till the grafting mark is about half an inch above the ground. The reason for this manipulation is to secure as much as possible a horizontal or downward position of the roots and to prevent them standing in an upward position.

Now the spade is again thrust into the ground as deep as before and 3 to 4 inches further away and the ground pressed against the planted vine. Then the earth is still pressed against the vine by foot. The vine is now covered with soil. Here one must be very careful to make the heaps of soil *fairly broad but not high*. The top of the vine must just be covered, so that it becomes visible after the first rains. If the grafted vine is buried, i.e. if it is too deeply covered with soil, then the young shoots will come out badly. They curl underground and are worthless when they at last reach the surface. Then they are largely exposed to the attacks of "mistworms" and in great danger of being destroyed by them during the time they try to reach the surface. Towards the end of October one should examine your recently planted vineyards and open carefully the heaps of those vines that show no trace of any shoots, destroy the "mistworms," break off the shoots of the American stocks, and open the tops of the vines so that they are just visible. In this way many a vine can be saved. I warn all farmers hereby against planting their vines too deep or too high above the ground, or against covering them too deeply.

6.—How must I Cultivate the Vineyard Soil?

Good cultivation of a vineyard has a very great influence on the quality as well as on the quantity of the vintage. A small vineyard carefully cultivated is often more remunerative than a much larger vineyard which is not properly looked after.

Let us now briefly see what a wine farmer should do to his vineyard soil, starting from the pressing season.

In France I noticed that after the vintage the vineyard is ploughed to a depth of 5-6 inches. This will undoubtedly have a good effect on the soil. The soil hereby becomes more fertile and retains its moisture better. Where our vineyard soils are loose enough in March it will certainly be advisable to try this.

If one is troubled by kalanders (especially in clayey and peaty recently trenched soils) then the soil around the stick should be removed and spread over the ground early in April. In this way the eggs of the kalanders are nearly all killed. In any case one can get altogether rid of kalanders by doing this several seasons in succession.

In May, or in the beginning of June, one ought to cultivate the vineyards with a Planet Junior or a similar plough. With this cultivation one may put the potash and phosphatic manures into the soil (Karroo ash or imported potash salts and bonemeal or basic slag). Although it is then still early, one may safely apply the above-mentioned manures as they are, so to say, not washed out of the soil. During the last half of July till the beginning of August the vineyard soil should once be cultivated deeply. Turning the vineyard soil by hand (by spade) I consider generally as the best method of cultivation. It is, however, somewhat expensive and sometimes cannot be done on account of scarcity of labour. Still I consider it very good at least to have part (one-half, one-third, or one-fourth) of the vineyard soil turned by hand. The remainder one can then plough. One should now plough deeper than usual (at least 6 inches) to prevent a hard pan from being formed. But this deep ploughing should not be exaggerated, so as not to injure the roots too much. It is advisable to make furrows in the middle of the rows and then to broadcast the nitrogenous manures (Government guano, sulphate of ammonia, or another kind of nitrogenous manure) over the ground and to plough the soil towards the middle of the furrows. If necessary, superfluous soil or grass can be removed from around the vines by spade.

When the winter rains are over and when the soil is dry enough, the vineyard is cultivated in all directions. After this the surface of the soil should be kept loose by cultivating it superficially with a Planet Junior or with some sort of a harrow. This one should do, especially shortly after summer rains to prevent the soil from forming a hard crust. By keeping the surface of the soil loose one prevents too intense an evaporation of the water in the soil and one thereby puts the vines in a position to mature their grapes well even in dry summers. Ever since our vineyards in the south-western districts were destroyed by the phylloxera the above-mentioned method of cultivation was followed with good results, although the summer irrigation in vogue in earlier days has altogether been abandoned. Irrigation of vineyards is now only found in some parts of the Worcester, Robertson, and Montagu Districts. Many farmers have the custom of making early in winter (April-May) square holes, 2 feet deep, between four vines, usually every third row. In these holes they put the vine canes and, later, also manure and grass. Furthermore, most vine leaves end in these holes. Generally, I consider the making of these holes as an unnecessary expense, and I doubt that any advantages are obtained thereby. To enable one to bring the vine canes into the soil they can be cut up by a "wingerd-lootje-machine" (one of which can be seen at the Oenological Station,

Paarl) and then put in furrows made in the middle of the rows and covered by ploughing in July or August.

Warning.—As the American vines have almost no bark around their trunks exposed to the sun, one should be careful to see that the grafted vines have so much soil around their stems that they are covered with soil till near to the grafting mark. If the American stem is exposed to the intense rays of the South African sun during the *summer months* it easily gets cracks, and the end of it is that such a vine dies off and one discovers then that its trunk above the ground has died off and got rotten. In many such cases the American stock sprouts again from underneath, thus proving that the evil in this case lies above and not below the surface. I have already seen many such cases, and wish therefore to draw the attention of every wine farmer to this fact. On slopes this occurs more easily than on even land. One should be careful not to plant the vines higher above the ground than that the grafting place is just visible.

Re the manuring of vineyards, I refer the reader to my article on this subject which appeared in the *Union Agricultural Journal*, Vol. 2, pp. 106, 195 (July and August, 1911). Copies of reprints of this article can be obtained gratis from the writer of this article at the Oenological Station, Paarl.

(*To be continued.*)

Inquiry into Dips and Dipping in Natal.

BEING PARTICULARS COLLECTED FOR THE INFORMATION OF THE SOUTH AFRICAN FARMER.

By Dr. A. Theiler, C.M.G., Director of Veterinary Research; and C. E. Gray, Principal Veterinary Surgeon.

(*Continued from page 829, Vol. IV.*)

II.—THE DIPPING FLUID.

Three types of dipping fluids may be distinguished which are at present in use:—

(1) Laboratory dip; (2) the arsenite of soda dip; and (3) the proprietary dips.

(1) Laboratory dip, the original composition as advised by Lieut.-Colonel Watkins-Pitchford, and also known as the five-day dip or the full strength dip (standard strength), consists of—

Arsenite of soda (80 per cent. of arsenious oxide)	8½	lb.*
Soft soap	5½	lb.
Paraffin	2	gals.
Water	400	gals.

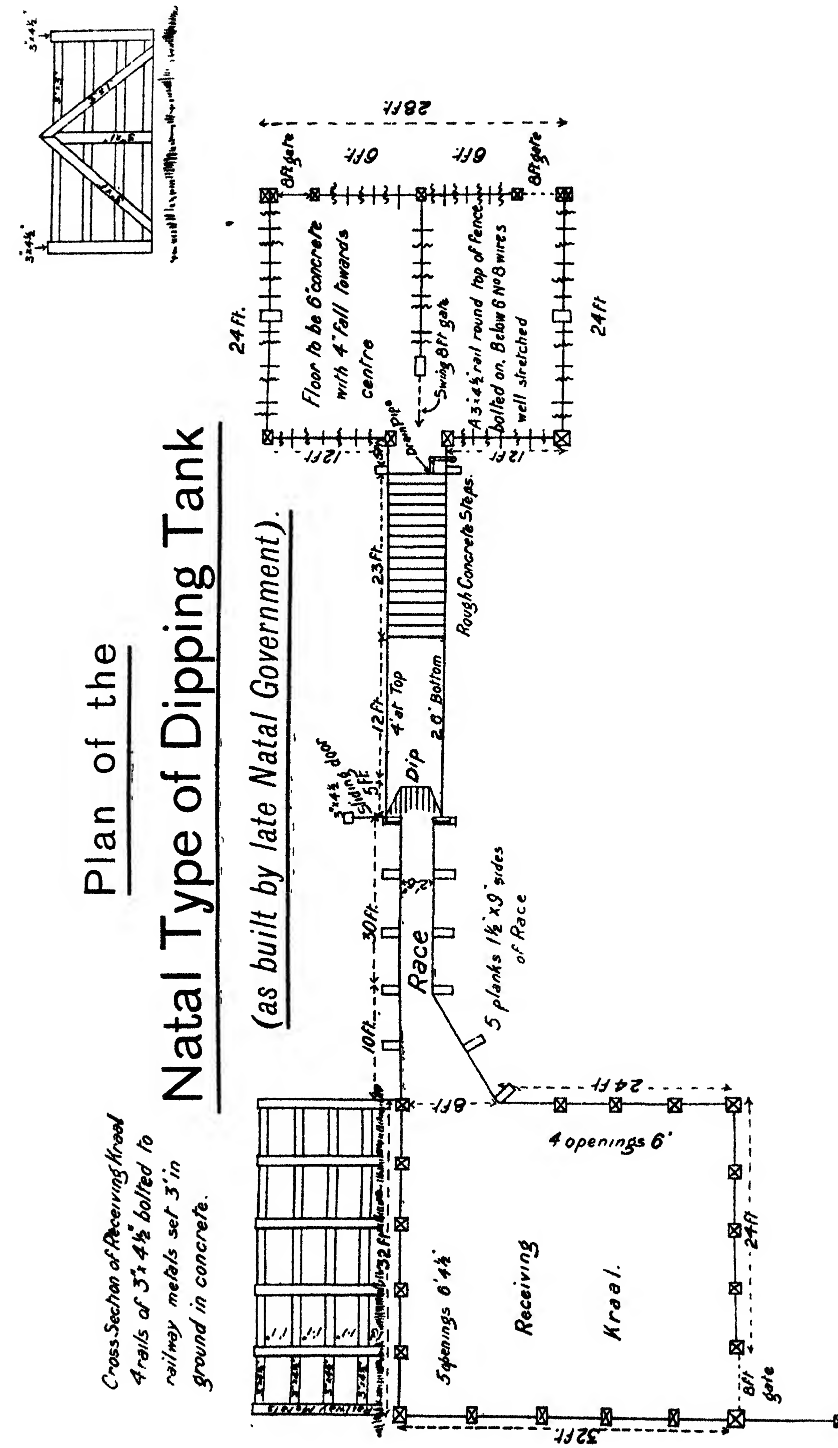
There is also ¾, ½, and $\frac{5}{12}$ strength dip, according to the recommendations of Lieut.-Colonel H. Watkins-Pitchford, containing respectively 6⅜, 4½, and 3½ lb. of arsenite of soda.

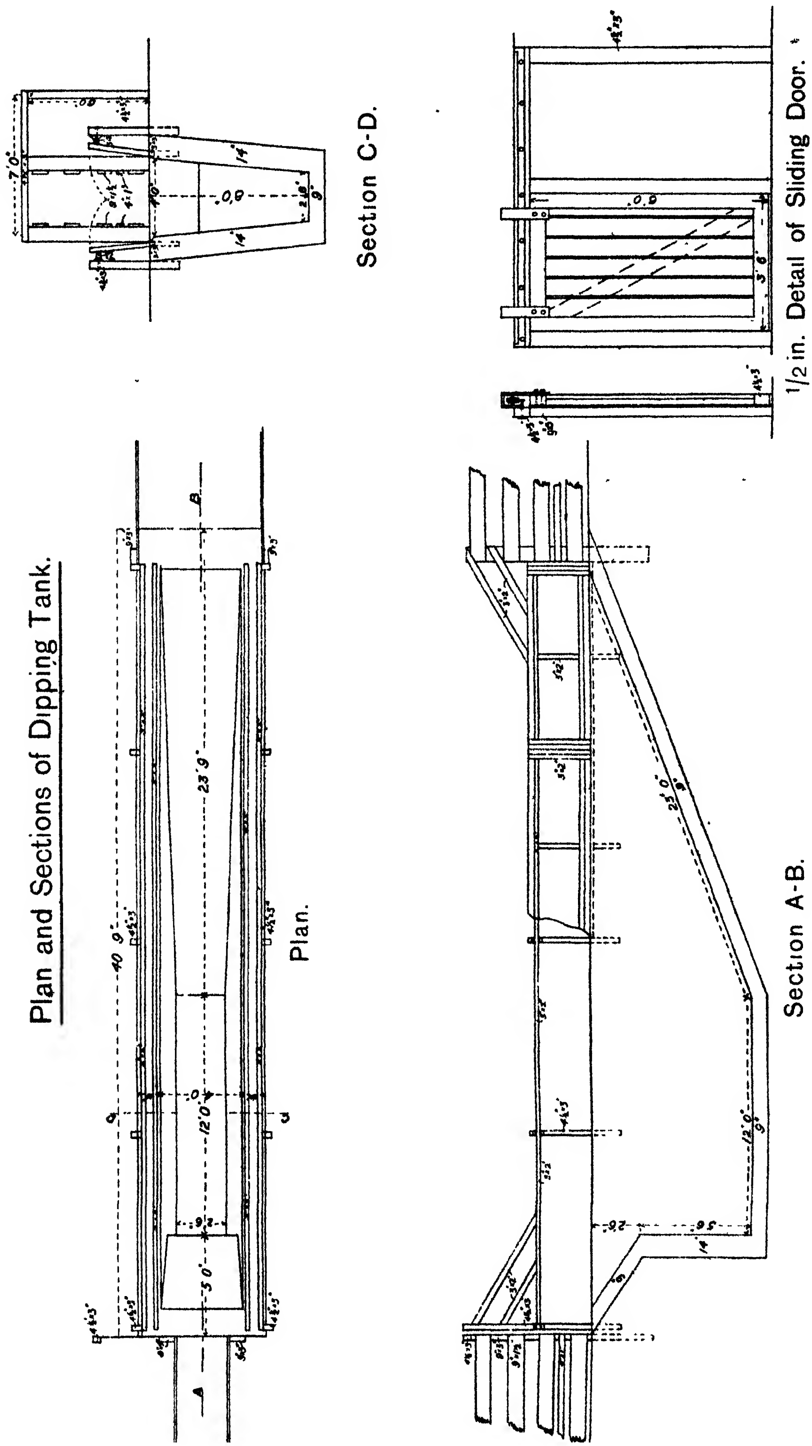
The instructions for mixing the dip are as follows:—Dissolve the soap in about 5 gallons of hot water; whilst still hot add this soap solution in small quantities at a time to the paraffin and beat or stir to a creamy lather. This makes the soap emulsion. Dissolve the arsenite of soda in a sufficient quantity (about 1 gallon) of hot water and when completely dissolved add cold water up to 50 gallons. This mixture can be made in the tank. The soap solution may then be gradually added, stirring thoroughly all the while. Water should then be added till the 400 gallon tank is full. When it is desired to fill the dipping tank the above procedure can be adopted for as many times as is found necessary, or one mixing may be made sufficient for the purpose. Four hundred gallons, however, is a sufficient quantity to handle at one time. If a film of oil floats to the top of the dip in the tank the dip should be stirred with a stick or board, before commencing to dip, or the oil may easily be removed by skimming; the proportion of alkali present in the soft soap (a proportion varying with different samples) determining to some extent the degree of emulsification of the oil.

* This has since been reduced to 8 lb.

Plan of the Natal Type of Dipping Tank

(as built by late Natal Government).





Plan and Sections of Dipping Tank.

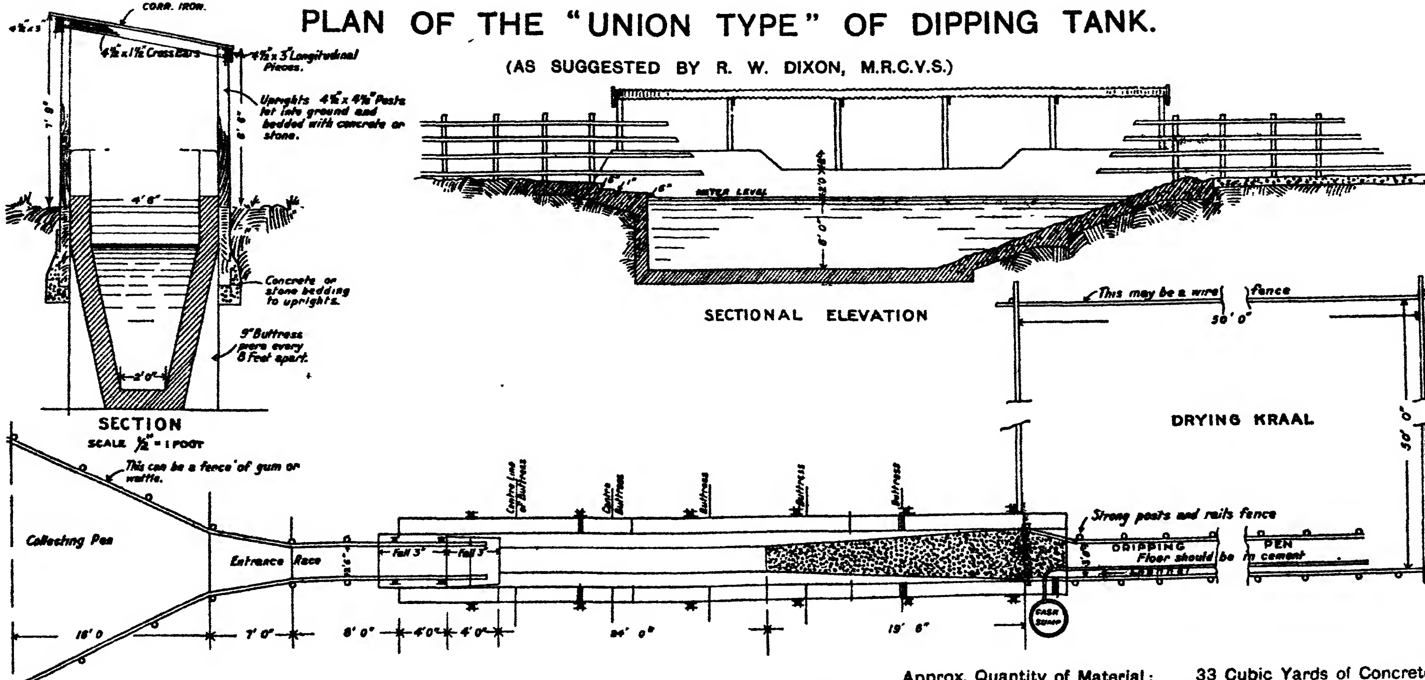
The dip known as the three-day dip or half strength, originally consisted of $4\frac{1}{4}$ lb. (this has since been reduced to 4 lb.) of arsenite of soda, 3 lb. of soft soap, and 1 gallon of paraffin.

These formulae are adhered to by a great number of farmers observing the intervals stated for their use, although in some cases the full strength is used for three days' dipping and the three-day dip used for weekly dippings. In practice the intervals of dipping are sometimes longer in winter than in summer and tend to be made longer when a farm is cleared of ticks, and since there is a difference of tolerance in animals when dipped for the first few times farmers have introduced some slight alterations based on their own observations, in the composition of the dip as well as in the method of its use. Although some farmers started straight away with full strength dip and have continued ever since to do so, others started with half strength or three-quarter strength and added more and more arsenite of soda until full strength was obtained, but it was frequently omitted to add at the same time the proportionate quantities of soft soap and paraffin. Some reduced the paraffin to half, some left it out completely and only used soft soap, others filled their dip with the standard formula and replenished as occasion necessitated with arsenite of soda solution alone. This probably led in the majority of cases to the exclusive use of arsenite of soda. It has also been a practice to add soft soap and paraffin to the summer dip and leave them out in the winter dip. From the answers obtained from farmers 46 per cent. are to the effect that arsenite of soda alone is used, whereas 39 per cent. still adhere to the Laboratory dip. It is, however, possible that a greater percentage of farmers use arsenite of soda alone, since in the replies to the query sheets the phrases three and five days' dipping) are used without mentioning the nature of the fluid, but on reference to other questions it can be gathered that the Laboratory dip has been discontinued in favour of the arsenite of soda. The remaining 15 per cent. use proprietary dips which are now also adapted to short interval dipping.

The pure arsenite of soda was originally advocated in the Cape in the strength of 65 per cent. arsenious oxide, and experiments had been made there by the Veterinary Department which proved its efficacy if used in a watery solution by itself and unmixed with any other ingredients. Some farmers state as one of the reasons why they dropped the use of soft soap and paraffin that paraffin was apt to distress the cattle and knock them up too much, cause sore teats and burning of the skin. The advocates of the arsenite of soda state that they find it just as effective by itself, and this being so it is comparatively inexpensive. Pure arsenite of soda in various concentrations is used, the strength being principally calculated to fit the period of dipping. In short interval dipping, or three days' dipping, 4 to $4\frac{1}{4}$ lb. of arsenite of soda are used for 400 gallons of water, and for five days' dipping 8 to $8\frac{1}{2}$ lb. Some farmers have reduced the dose for five days' dipping to $7\frac{1}{2}$ and to 7 lb.; on the other hand, some exceeded the normal strength and used 9 to 10 lb. for 400 gallons of water, others who started with 10 lb. reduced it again to 8 lb. This increased amount is not only intended to make sure of killing the greatest number of ticks when they are particularly troublesome, but also it is particularly used in cattle well accustomed to longer intervals of dipping. In the case of these deviations from the prescribed formula,

PLAN OF THE "UNION TYPE" OF DIPPING TANK.

(AS SUGGESTED BY R. W. DIXON, M.R.C.V.S.)



GROUND PLAN.

Approx. Quantity of Material: 33 Cubic Yards of Concrete.
Approx. Cubic Capacity of Tank: 3900 Imp Gallons.

TIMBER, Etc., REQUIRED FOR ROOF

- 6 Uprights each 11' 0" long x 4½" x 4½"
- 6 " " 10' 0" long x 4½" x 4½"
- 28 ft. run of cross ties 4½" x 1½"
- 92 ft. run of longitudinal pieces 4½" x 3"
- 24 Sheets of Galvanized Iron 8 ft. long.

SCALE 16 FEET TO THE INCH.

Proportions.	Amount Required.
6 Stone	198 Barrels.
3 Sand.	99 Barrels.
1 Cement.	33 Barrels.

—say 12/6 each CT

considerable use is made of the isometer invented by Dr. W. Watkins-Pitchford, his instructions for use being as follows:—Two tubes—one of which is graduated—are held in a metal frame attached to one end on the containing wooden cases. This frame serves as a stand for the testing apparatus which is blackened to prevent reflection of light through the fluids.

The method of testing is briefly as follows:—The plain tube is filled with the dip fluid to be tested. The graduated tube is filled by the coloured testing fluid as far as the first mark on the tube. The dip in the plain tube is then poured cautiously into the second or graduated tube where it mixes with the testing fluid. As the mark numbered ten is approached in this latter tube the colour of the fluid gradually changes, and when the mark is finally reached the tints of the two tubes are exactly alike. When, however, the dip to be tested is stronger than the standard (Laboratory Dip) the identity of colour of the tubes is reached before the fluid reaches to the mark 10. Conversely when the dip is weak the column of fluid is not matched in colour until it reaches above this mark. The point at which colour correspondence between the two tubes takes place is noted on the graduated glass scale of the tubes, and the number of this graduating is found upon reference to an accompanying table to give the exact amount of arsenite of soda or of water which is necessary to bring the dip to the standard strength.

The addition of Kerol to the arsenite of soda is mentioned by some farmers, and it is thought it has a more tick deterrent effect than paraffin, whilst others use Kerol to prevent the offensive smell a dipping tank is apt to develop.

The replenishing of the tank is done in different ways; some tanks are graduated, and a simple calculation is necessary to find out how much water has to be filled in and what quantity of arsenite of soda must be added. Another widely used method is to have alongside the tank a smaller tank of a capacity of 400 gallons, and in this tank the mixture is made up and allowed to flow in to the dip tank as required. Neither of these two methods allow for concentration of dipping fluid by evaporation, which, however, as we shall see later is very small. The use of the isometer is recommended by many farmers to keep the concentration at a permanent standard.

WASTAGE OF DIP.

The sources of loss of dipping material are leakage of the tank, evaporation, and loss caused by carrying away on the coats of the animals dipped and by splash.

(*a*) *Leakage.*—Leakage of the tank has only been noticed in a few cases, and more frequently in the cheaper class of tank, but such leakage has usually been noticed to stop when paraffin and soft soap was added to the liquid. The following hints might prove of interest:

"(1) A good thing with a new tank is to cement-wash it twice with wash fairly thick and then tar the tank when you can be sure all will be well. Before filling with dip let the tar dry hard, as it should be applied *hot*; (2) another suggestion is repair the leakage with one-third barrel of cement mixed with one bucket of skimmed milk; (3) a third remedy is a coat of coal tar; and (4), finally, one suggestion is that the tank should be emptied and the surrounding ground soaked with water so that the leakage can be detected."

(*b*) *Evaporation.*—Loss by evaporation is estimated by the majority of farmers to be insignificant, especially in tanks covered with a roof. Some statements are to the effect that between two dippings the evaporation amounts to from 1 to 6 gallons, depending on the weather and on the locality in which the dip is placed.

The following figures will give an idea of the extent of evaporation to be expected under the various conditions:—

Dry weather.
120 gallons a month.
200 ,, ,,
Hot weather.
96 gallons a month.
Dry, hot weather.
55 gallons evaporated out of a 3000-gallon tank.
Very hot weather.
200 gallons a month.
Windy weather.
120 gallons a month.
Winter (three months).
400 gallons in a 26,000-gallon tank.
300 gallons during winter months.

In spring-time the loss is stated to be considerable.

Some farmers draw attention to the fact that in the course of time a dip does occasionally get stronger and they connect it with the evaporation. The isometer is apparently largely made use of to adjust such irregularities, especially when dipping is discontinued during the three winter months. It is also stated that after continuous dipping a decrease in the strength takes place, and this has been explained to be due to an oxidation product of the arsenite of soda which is less soluble.

INTERVAL OF DIPPINGS.

This question must be dealt with from the two points of view, whether it is done on a farm infected or not infected with East Coast Fever. Although in both instances definite procedures are indicated, they can be carried out with varying intensity under different conditions. We propose to deal here with the first part of the question. The interval of dipping depends apparently on the purpose a farmer has in either eradicating the ticks completely or in keeping them only in check; in both cases the degree of tick infestation of a farm comes primarily into consideration (one farmer states that he only dipped his cattle at the request of the stock inspector, although this has only been on rare occasions, accordingly the dipping interval varies in the various altitudes—high, middle, low veld, and coastal belt in the various seasons, summer and winter in particular, on the fact whether dipping or spraying have been done previously, and, finally, on the conditions of the cattle. A few farmers dip at intervals of three days with the object of killing the maximum number of ticks in the shortest possible time; others for the same reason only dip every four or five days, and again others only once a week. These periods are adhered to in the majority of cases until a reduction in the number of ticks becomes visible or when the cold weather makes it impossible to continue. Once the reduction is obtained the usual interval is extended to a

week in the majority of cases, to ten to fourteen days in many others, and to three weeks or a month in the warmer parts of the country during the winter. Only a few farmers who had no fear of East Coast Fever stated that they dipped at short intervals of three to five days throughout the year, and these live in the warmer parts. The farmers of very high altitudes suspend operations during the winter completely, as the temperature frequently falls below freezing point and the water in the dip on an early morning may be found frozen. The months, June, July, and August are those during which no dipping takes place. One farmer stated that he dipped till late in the winter, and as a consequence lost thirty head of cattle; others say that they examine their cattle in the cold months, and when ticks are present they arrange to dip on the first warm day. Some farmers use a different strength of dip for winter and summer dipping, making it as a rule weaker in winter so as not to be severe for cattle, or it is thought that the winter coat is so much heavier, a larger quantity of dip is absorbed and a longer time required to dry, a more pronounced effect on the ticks must be effected. In cases where dipping is suspended during the winter months a recommendation is to the effect that dressing, particularly of the tail, should not be neglected. The three-days' dip is occasionally adopted for a weekly dip, and the five-days' dip for a weekly dip in spring, the period in summer being reduced again to five days. In some cases a five-days' dip is used in summer, seven-days' in spring and autumn, and fourteen-days' in winter. Milch cows are often less frequently dipped than dry cows or oxen, since the milk supply, as will be shown later, is undoubtedly affected by the dipping. Another deviation from the regular routine is to dip cattle freshly introduced on to a farm more frequently during the first month.

ROUTINE OF DIPPING.

Regular intervals being observed in the various seasons, a strict carrying out of them necessitates a routine which must fit in with the regular farm work of the week. The advocates of short-interval dipping either stick rigidly to the three days' interval during the season suitable for it, on whatever day of the week the dipping may fall, or allow the Sunday to fall out and prolong or reduce the interval from three to four or from five to four days as the case may be. The usual weekly dipping falls as a rule on a Saturday, the reason given being to give the oxen a good rest for as long a period as possible. A similar reason is given in the case of milch cows, the dipping affecting the milk supply, which by Monday will be normal again. Others dip on Wednesdays, Thursdays, or Fridays, having noticed that the effect on dipped oxen is more pronounced on the third, fourth, or fifth day after dipping respectively. A definite day has been found advisable for natives and herd-boys, who will remember it better, and whenever the native tenants' cattle are dipped by the farmer they know that they have to be in readiness on that particular day of the week. Some farmers fix on Thursdays or Fridays, so that if the weather is not favourable they can postpone it until next day and thus minimize the chances of dipping on a Sunday if the previous Saturday happens to be wet.

Farmers who have large numbers of cattle distribute the dipping over two or more days of the week, others dip the milch cows on one

day and the working cattle on another. In one case Monday is selected because the farmer considers dipping the most important job of the week and one which should be done first.

METEOROLOGICAL CONDITIONS SUITABLE FOR DIPPING.

The few strict advocates of regular interval dipping do not allow the meteorological conditions to alter their arrangements, as in their opinion the presence of East Coast Fever on the farm or near by is of more importance than the risk of injuring cattle as a result of dipping in inclement weather. Nevertheless, if certain conditions are present (such as extreme heat or cold, heavy rain, or boisterous winds), dipping is, generally speaking, suspended for the day. There are some statements to the effect that the weather has never prevented the adoption of a fixed dipping day, and in other cases it is said that the necessity for postponement only occurs very rarely, perhaps once or twice in a year. All farmers sound a warning against dipping in a thunderstorm or on a very wet and rainy day, as they consider the effect of dipping would be nullified, inasmuch as the dip is washed off, and some of these also draw attention to a possible poisoning of the veld. Dipping on a cold day is to be deprecated, as cattle suffer whilst standing about and going through the dip; when in the drying pen they can be seen shivering and looking miserable, and afterwards refuse to feed; milch cows give much less milk, and cattle generally lose rapidly in condition. Windy days are not liked, because the tank is then said to foul more easily and it is stated that on such days cattle are reluctant to being dipped, going in with more difficulty. On the other hand many replies are to the effect that if cattle are inured to dipping, climatic conditions, etc., do not matter at all. Very hot days are condemned, because it is said that the skin of some cattle blisters readily on such a day, and also the working oxen are considerably more affected than under more favourable conditions. The effect of a very hot day on dipped cattle is said to be very marked, cattle looking for shady places, where they stand for hours refusing to feed. Provided the extremes of weather conditions are absent, the farmers still give a preference for certain days against others. In summer, a day slightly overcast or cloudy is by far the most suitable, particularly when the temperature is medium and the air still, since the dip does not dry off the animal so quickly and therefore is more effective on the ticks. In the winter a bright sunny warm day is advocated.

TIME OF THE DAY SUITABLE.

The interval being fixed and the weather being favourable, the time of the day is also taken into account for the dipping. Various motives account for different practices: season of the year and farm work are apparently the main ones.

In summer most people dip as early in the morning as possible before sun-up, particularly during the hottest days, and in the forenoon or midday in the winter, in order to allow the cattle to dry properly. This practice has the additional recommendation of allowing the oxen to have a good rest before inspanning them. The hottest time of the day is generally avoided and evidently for good reasons. A farmer states that he once lost twenty-three head of fat oxen which were dipped at 2 p.m., these animals having been driven up to the

tank in the heat of the day; the rest of his herd had been dipped in the morning without any ill-effects. Cows are milked first and then dipped to prevent the calves sucking on the dipped udder and to prevent the dipping material dropping in the milk bucket. Some farmers take into consideration the decrease in the yield of milk as the result of dipping, preferring to milk very early in the morning and to dip as late as possible the same day. In the summer-time dipping late in the afternoon is occasionally adopted after the oxen have been outspanned and when there has been a very heavy mist in the morning. In other instances farmers wait until about 10 o'clock so that they can form an idea of the weather prospects for the day. Some consider the effect of the hot sun on a dipped animal as a cause of blistering, and prefer the cooler hours of the day for the operation. In various localities the morning is used, because in the afternoon thunderstorms are frequently apt to occur regularly at certain times of the year. It is stated that cattle are more easily manageable for dipping when the sun is well up, viz., about 9 o'clock, especially when the mornings are cold. Generally speaking, the morning seems to be preferred from all points of view as the best time, as it interferes least with the farm work, cattle usually being at hand in kraals and paddocks, having been collected either the day before or immediately after sunrise. The farmer who dipped his cattle in the forenoon has made the statement to the effect that he finds the sun acting on the cattle kills the ticks better.

TIME REQUIRED FOR THE OPERATION.

A point of consideration from a farmer's point of view is the time required for the dipping process; it is pointed out that the actual dipping does not require so much time as the collecting and bringing up of the cattle, accordingly it requires some foresight and management to have everything in order when the operation begins. As stated previously larger draining pens allow of faster dipping. The time given by the Natal farmers is very quick indeed, and the actual period one beast takes to go through a dip is as short as six seconds, particularly when the cattle are accustomed to dipping, the beasts know what is going to happen and follow each other into the dip like clockwork. A difficulty is experienced in cattle dipped for the first few times, some of them show great reluctance, stop in the crush on the inlet or on the slope and try to turn round. They have to be pulled on by means of a rope placed around the horns and dragged into the dip, and in one instance a windlass is in use for this purpose. We might say there are also records in dipping, when a maximum number of cattle are dipped in the minimum time, but apparently these records are only obtained when cattle are accustomed to dip. Some examples may serve to illustrate the foregoing. Eighty yearlings require eight minutes to go through the dip; 135 cattle require twenty minutes; 250 require one hour; to dip 320 beasts requires 1½ hours; another farmer with the assistance of four natives put 250 head of cattle through the dip in one hour, but required two hours to collect them; 100 head took forty-five minutes to sixty minutes; 200 oxen required one hour, having been outspanned and sent directly to the dip. By sending the cattle through the dip one by one a farmer manages to do his head of 250 in two hours. The collection of 300 head takes two hours and dipping one and a half

hours; 400 head were dipped in one hour on one farm, and in two hours on another. The dipping of 500 animals required four hours in one instance, and in one hour and ten minutes in another. The latter farmer states, however, that the beasts require sometimes twice as long. Where the mob is too large to do the dipping comfortably in one operation the animals are split up in herds and dipped on succeeding days, but the erection of a second dipping tank to facilitate operations has also been advised. 450 have been done in two hours, and in the case of a large mob numbering from 1000 to 1500 dipping is started in the early morning and completed by 1 o'clock. Since a good many farmers perform the dressing at the time, the periods are slightly longer in various instances according to the procedure adopted, about half the time necessary for dipping being required for dressing; some farmers evidently do it so thoroughly that double the time is required.

The notes indicate that generally speaking the time required for dipping and dressing depends on the number of cattle, the cattle themselves, length of the tank and draining pens, size of the farm, method of herding and kraaling, whether hand-dressing is resorted to or not, and last, but not least, to the managing capabilities of the farmer.

HAND-DRESSING.

Not all farmers consider that dressing is necessary; some say "yes," others simply reply that they make no use of it; another party rely solely on the effect of the plunge, whilst a fourth group gave up dressing only eighteen months or two years ago, due to the decrease of ticks on the farm. The parts which are usually dressed are the regions immediately under the tail, around the eyes and the ears (the latter superficially and even into the depths of the ear), the regions around the horns are also attended to by some, and a few dress the regions between the hind legs and the udder in cows and the sheath in oxen; the space between the hoofs is also attended to by several. In addition to this the practice exists of cutting the hair fringes of the ear and the brush of the tail. About the suitability of this latter operation opinions differ, and the motive for this appears to us to be regulated by the object of the farmer. Many of those who do not cut the brush state that the brush serves as a collector of ticks, and the ticks are collected and killed by the usual dipping; some farmers even go the length of prolonging the time the cattle are in the tank so that a good supply of ticks can be killed at once; others dip the brush in the strongest solution of the same dip—sometimes double strength; some hand pick them, and again a few smear the brush. On the other hand it is reported in some cases that ticks have never been found on the brush. One correspondent states he gave up cutting the brush, as he finds the animals do not keep their condition so well as with the brush on. There does not seem to be any regular periods for cutting off the brush, as it is done yearly, half-yearly, quarterly, and even monthly. Combing of the brush is adopted as an alternative treatment in some cases. It appears that if the farmer is not afraid of East Coast Fever he does not pay so much attention to the tail, but utilizes the brush to collect as many ticks as possible, whereas the man who is in fear of East Coast Fever cuts the brush in the majority of cases since there is some difficulty to get at the ticks,

and he is quite justified in his action, as the ticks are then forced to attach themselves to other parts of the body where dipping is more effective. Hand-dressing is also effective under such conditions for other parts of the body, but more particularly to the ears. Smearing with castor-oil and arsenite of soda is intended to kill the ticks present and to prevent others from getting there, although some farmers condemn the use of greasy materials, stating that they act as a waterproof on the places smeared, and recommend syringing with liquid material, some using the same dip, some slightly stronger.* The favourite prescription appears to be 2 oz. arsenite of soda, 1 gallon of paraffin, 1 lb. soft soap, and 2 gallons of water.

The greasy substances are generally applied by hand, but in the case of the ear a swab is frequently used, consisting of a stick with a piece of sheep skin attached to the one end. A great number of dressing materials are used and advised by farmers. The most favourite one seems to be a mixture of brick-oil, 20 parts, 1 part paraffin, and tar 1 part (stockholm and archangel tar). Much use is also made of the mixture of paraffin and paraffin candles as recommended by Lieut.-Colonel H. Watkins-Pitchford, against which, however, some farmers raise the complaint of expense as compared with other drugs. Castor-oil and tar, cocoanut-oil and tar, grease and Kerol, Cyllin with paraffin and brick-oil, fat and nicotine, anti-friction grease and paraffin, extract of tobacco, vacuum oil, anti-friction grease and tallow are made use of, lubricating oil already used by the engine, lard, mixtures of fat, sulphur, and Cooper's dip. Another favourite seems to be 1 lb. of hellebore powder, 8 bottles of paraffin, 8 bottles of castor-oil, lard, or tallow. Dressing is not carried out in the same way by all farmers, but can be summarized under the following headings:—(1) After every dipping; (2) in between dippings, when it is said to be more effective; (3) before the cattle are put in the tank; (4) when cattle come out of the tank; (5) only in summer when ticks are plentiful; (6) in winter when cattle are not being dipped; and (7) only when ticks are found to be present. Instead of locally attending to the heads some farmers immerse the heads of cattle a second time as they may swim along in the tank. Various proprietary mixtures are also in use, such as Cooper's tick grease, Little's cattle smear, Quibell's paste, Hayward's paste, etc.

ATTENTION TO HEAD.

It has often been stated that the head of an animal is the part which most frequently escapes immersion, and therefore requires particular attention, since ticks find suitable places to hide there. A special query was put to farmers to find out to what extent this happens and what is done to remedy it. Some state that they never noticed it, and the majority say that it is only in a few instances that the heads fail to be immersed. One farmer states that if his cattle are allowed to jump into the tank quickly the rear one makes a wave which will effectually soak the head of the preceding animal. It appears that in the case of a sheer drop or in a very steep slope these escapes are but rarely met with. In the sheer drop, the animals must get immersed as a result of the jump, and in the steep slope type it is said that the head plunges in first. The failure to immerse the

* In one instance a report is to the effect that the cattle are now just as clean without hand-dressing as they were two years ago after the measure had been discontinued.

head is said to more frequently occur when the animal slides into the tank on a not sufficiently steep incline. Some farmers also make the statement that the level of the fluid in the tank has some influence, inasmuch as if the tank is too full the cattle are more apt to slide in, whereas when the water is a little below the drop, especially in a slope, the cattle take a jump. Attention has been drawn to the fact that not infrequently the escape of the head happens when cattle follow each other too quickly, the following one jumping on the back of the preceding one. In a few instances it has occurred that it is the same animal that always manages to escape plunging; sophisticated animals often sit down on a slope and slide in, thus escaping complete immersion. This particularly is stated to be the case with horses, mules, and donkeys, which seem to practically always manage to escape taking a complete dive. Prevention apparently lies in the proper arrangement of the intake as explained before. To ensure the immersion of the head some farmers push the head into the fluid with a forked stick; others have a native sitting across the tank in such a position as to enable him to push down the head as the animal comes along; another hangs a bag across the tank under which the animal is supposed to duck; others pour a bucketful of dipping fluid over the head of the animal as it comes out; others rush the animal into the dip as soon as they notice it hanging back; others again dip them a second time when the animals very rarely escape. A good many, however, rely completely on the dressing and spraying, giving special attention to those animals which come through with a dry head. It is also stated that no attention is given any longer to this once the farm is cleared of ticks.

DIPPING OF PREGNANT COWS.

Experience has shown that almost without exception dipping of pregnant cows up to the time of birth has no ill-effect on the animals. A good many farmers state that cows have calved on the afternoon of the dipping day, whilst there are answers to the effect that some cows calved within a couple of hours after dipping and the record is five and ten minutes after dipping. Generally it is stated that cows which were about to calve are exempted from dipping but go into the dip on the next occasion or in about a week's time; others leave the cows alone for a few days to a week, a fortnight, a month, and even more. In some cases trouble with the after-birth is attributed to the previous dipping of the cows; in one other a farmer reports that he has had more dead calves since dipping the pregnant cows than previously, and a resident in the high veld maintains that dipping during the winter months results in about 4 or 5 per cent. of his pregnant cows aborting.

In many instances the pregnant animals are dipped by themselves, care being taken not to put them into the mob as the poking and goring is considered to be more injurious than the dipping. Some farmers only exempt cows with a very big udder as they have found that the regions touching the udder and the legs suffer frequently in these animals, whilst others who now exempt their pregnant cows did not do so when East Coast Fever was on their farm or near by. In the majority of cases where pregnant cows are exempted from dipping spraying and hand-dressing is resorted to. Of course all this seems to be dependent on the state of tick infestation on the farm and the threatening danger of East Coast Fever.

AGE OF CALVES DIPPED.

The practice varies here on the different farms. Some farmers dip the calf on the first occasion whilst others wait for the second or third dipping day. It is said to be advisable to send the calf into the dipping tank directly behind the mother as it will then follow her through the tank. Other statements are to the effect that calves are kept from a fortnight to six months before they are dipped, and the majority allow one of the longer periods to elapse. Calves are considered to be more liable to blister as a result of dipping than full-grown animals, and it is probably for this reason that there is such a variation in the recommendations. One farmer thinks that dipping his calves too early is responsible for cases of poisoning owing to the dipped calves sucking each other's ears. Generally speaking, calves are dipped as soon as they are turned out to graze; in the meantime they are kept in calf sheds, open sheds, or special paddocks. One farmer stated that he only dipped calves when they saw ticks on them; again some calves are frequently not led to the dip as often as adult cattle, longer intervals being allowed at the beginning and being gradually shortened as the calf grows older. In other instances calves are first sprayed, washed, or sponged before accustomed to being dipped.

These practices are apparently subject to various conditions, particularly whether East Coast Fever is prevalent and whether the young animals are of much value or not.

DIPPING OF EQUINES.

We can safely say that the majority of farmers never dip their horses, mules, or donkeys, partly because horses are usually stabled and groomed and ticks are stated to be found but rarely on them. In the case of stabled horses hand-dressing is sometimes resorted to. The reason given in one instance is that dipping of horses, mules, donkeys, sheep, and goats would not leave time for ordinary farm work. Others submit horses to the dip, not mules; and a few, mules but not horses, such as for instance when the mules returned from trek; others only adopt occasional spraying and dressing, and again some only dip when ticks are noted on them or during the horse-sickness season. A few farmers who dip their horses gave it up again owing to frequent injuries and dipping of donkeys was also abandoned by some on account of the endless trouble caused whilst they were in the dipping tank. One man even states that it is cruel and dangerous to dip donkeys. Only a few farmers dip horses at short intervals, three days in one instance and during the horse-sickness season it is frequently about a week. Intervals of from fourteen days to one month are more frequently observed, whilst it is said in some cases that only one or two dippings are undertaken in a year.

It is said that brood mares when heavy in foal should not be dipped, although on the other hand it is maintained that with care no mishap should result. Others dip the horses only when they return from the summer veld or before they go to the winter veld. It is thought by some farmers that the small number of ticks on horses does not warrant exposing them to the risk of injury whilst dipping.

In one case horses are only dipped if ticks are numerous, whilst in another instance a farmer stated that the result of dipping foals every three days was "simply marvellous," since in the non-dipping days his foals were all stunted in growth.

DIPPING OF SHEEP AND GOATS.

It appears that only a small number of farmers dip sheep to eradicate ticks, and the question put was answered to the effect that for many years past they have not had scab on their farms and they do not require to dip. A good many farmers consider the dipping of sheep and goats unnecessary as they consider them immune to East Coast Fever; others only dip sheep as frequently as the regulations require, whilst a few say they only do it when scab is present and some only dip sheep when first brought on to the farm. Where sheep are dipped for tick eradication it is only done at very long intervals and naturally not all classes of sheep are treated in the same way. In the majority of cases sheep are dipped in their own tank with special sheep dip, in a few instances in the cattle dip, but then the precaution is taken to dip the sheep after the cattle tank has been cleaned out and freshly filled; the woolled sheep are sent through the tank first; frequently dipping is undertaken after shearing. Many farmers protest against dipping woolled sheep in a dirty cattle tank, whilst others who dip sheep before the wool has grown long take care to skim the surface of the dip before they put sheep into the tank. One man stated that he found the wool perished, whilst another stated the price of the wool was not affected. The haired sheep, such as Persians and Africanders, and also goats when dipped are more frequently dipped, once or more times a month, goats even as frequently as every seventh day, either in their own dip or in the cattle tank. Many farmers state that they did not find any ticks on their sheep or goats, accordingly it was not necessary to dip them. The use of a paraffin dip for woolled sheep is especially to be discouraged. One farmer says he first mixes his cattle tank to the strength of 11 lb. of arsenite of soda to 400 gallons of water then dips his sheep and goats and when finished adds so much water as to reduce the strength to 8½ lb. and dips his cattle. It is also stated that the cattle tank does not lend itself for sheep dipping. Others who tried it propose to build an extra tank for sheep. One farmer who uses the cattle dip for his sheep adds sulphur to the liquid when dipping the sheep. Some correspondents draw the attention to the great waste of dip when dipping woolled sheep in a cattle tank; in some cases a sheep dip is erected parallel to the cattle dip and when sheep are finished dipping the liquid is pumped into the cattle tank. Whilst East Coast Fever was present on the farm, some farmers dip the goats (that frequently belong to native tenants) every fifth day. A resident in Alderley remarks that previously he could not keep sheep on his farm, but since he commenced dipping he is able to run Merinos.

DIPPING OF PIGS AND DOGS.

Although not put in the query sheet many statements are to the effect that pigs and dogs are more or less regularly dipped, whilst some state that all quadrupeds go through the dip.

GENERAL REMARKS *re* DIPPING OF NON-BOVINES.

It appears to us that although it seems natural to expect that if all farm stock could be dipped the ticks would disappear much quicker, yet the practice in Natal and the results obtained do not prove that such is necessary. Cattle apparently are the best and most common tick collectors and their dipping alone when carried out systematically and carried out over a prolonged period will clean a farm of ticks.

3

CARRYING AWAY OF DIP.

The loss of dip due to it being carried away on the coats of animals is stated to vary in winter and in summer according to the more or less heavy coat. The majority of the estimates vary from less than half a gallon to three-quarters of a gallon, although the extremes are outside these figures. It is said in one instance that if the dip is freshly prepared it will drain off the animals quicker. The average loss is calculated to be about half a gallon in summer and a little more in winter; some estimate the amount in winter to be one gallon.

A farmer gives the following example: he puts 250 animals through the dip every fifth day, equal to 1500 animals per month, and returns back to the tank monthly 800 gallons, that is a loss of just under half a gallon per beast per month. Another farmer states that 400 gallons will do about 800 head and in winter 600. These wastages are made good by replenishing the tank at intervals, either after every dipping, or after a few weeks or months; it apparently depends on the number of cattle dipped, which can easily be calculated from the average amount taken out per beast.

COST OF DIPPING.

The estimates for dipping an animal vary from one-sixteenth of a penny in the lowest estimates to 2d. per head in the maximum. The estimate given per head a year varies from less than 1s. to 3s., and the estimates per hundred head from 6d. to 4s. per dipping. Some of the lower estimates include labour and hand-dressing, and some notes are to the effect that dipping is cheaper when arsenite of soda alone is used.

Farmers who formerly used to spray cattle state that this method was a very expensive one compared to the dipping.

As an example for the cost of dipping the following figures may prove interesting:—

(*a*) *Full strength of Laboratory Dip*—

Soft soap at 4d. per lb.
Paraffin at 1s. 1d. per gallon.
Arsenite of soda at 5d. per lb. (wholesale prices, Pietermaritzburg), according to Lt.-Col. H. Watkins-Pitchford.

Working on the basis of 100 head of cattle being dipped every fifth day with the Laboratory Dip for a period of a year, the amount of dip carried away would therefore be $\frac{100 \times 365 \times 1}{5 \times 2}$ gallons, or 3650 gallons, the cost of which, on the above estimate, equals—

72 lb. arsenite of soda	£1	10	0
49½ lb. soft soap	0	16	6
18 gallons paraffin	0	19	6
3600 gallons water		—	
	£3	6	0

In other words the cost of dipping 7300 head of cattle (100 every fifth day for a year), allowing for half a gallon of dip being removed by each animal, would be £3. 6s., or one-fifth of a penny per animal per dipping.

(*b*) *Full strength Arsenite of Soda*—

In this case 7300 head of cattle could be dipped at a cost of £1. 10s., or one-twentieth of a penny per head per dipping.

(*c*) *Cost of filling the tank*—

This initial outlay varies, of course, according to the capacity of the dip, but the following instances will give an idea of what this figure amounted to:—

Capacity of Tank.	Initial cost of filling the tank with full strength, (*a*) Laboratory Dip.	(*b*) Arsenite of Soda Dip.
2400 gallons	£2 4 0	£1 0 0
3000 gallons	2 15 0	1 5 0
3600 gallons	3 6 0	1 10 0
4000 gallons	3 13 4	1 13 4

(To be continued.)

Oxidation of the Arsenite of Soda in Dipping Tanks.

By C. Williams, B.Sc. (Lond.), A.R.C.S. (Lond.), Chemist, Central Experiment Farm, Cedara, Natal.

Some anomalous results obtained by the writer in the early portion of 1911 when engaged upon the analysis of arsenical dipping fluids for farmers in this Province, led him to institute a series of investigations on this subject. It was found that samples of these dip fluids, after being kept in the laboratory for a short time and examined again, often showed a distinct loss of arsenite. In order to pursue this matter further a certain quantity of fluid was made up according to Pitchford's "Laboratory" formula for a seven-day dip, and in addition to the arsenite of soda, paraffin, and soft soap, some droppings from the cow-byre were added so as to make the conditions approximate as closely as possible to the actual in the dipping tank. This fluid was analysed immediately after it was mixed and also at various intervals subsequently, the fluid meanwhile being kept in a stoppered bottle in the laboratory. Some of the results obtained with this sample are given in the following table:—

Dip Fluid made up according to the "Laboratory" Formula.

	Strength of dip on 31st May, 1911, immediately after it was made up.	Strength on 19th April, 1912, nearly eleven months after it was mixed.	Strength on 2nd September, 1912, about sixteen months after it was made up.
	%	%	%
1. Amount of Arsenic in form of Arsenite (calculated as Arsenious Oxide, As_2O_3)	0·166	0·047	0·007
2. Amount of Total Arsenic (calculated as Arsenious Oxide, As_2O_3)	0·171	0·171	0·175

It will be seen that there was a rapid loss of arsenite taking place in this sample, until after a period of about sixteen months there was practically none left, but on the other hand, the amount of *total* arsenic in the fluid remained constant, the slight increase shown in the last column being probably due to the evaporation of a portion of the water. The only explanation admissible is that owing to some cause or other the sodium arsenite has been changed to another substance having some other compound of arsenic besides arsenious oxide as its basis.

To the uninitiated it may be explained here that the element arsenic combines with oxygen to produce two oxides—(1) arsenious oxide, and (2) arsenic oxide; the former is known commonly as white arsenic or simply "arsenic," and contains a smaller proportion of oxygen than the latter. The two oxides will combine with water to form arsenious acid and arsenic acid respectively, and these acids, as in all other cases, will combine with various metallic oxides to produce "salts," those corresponding to the former acid being known as arsenites, and the salts of the latter acid, arsenates. It will be therefore evident that the arsenates contain a larger proportion of oxygen than the arsenites, and if sodium arsenite, for example, is made to combine with more oxygen, i.e. oxidised, it gets converted to sodium arsenate.

In estimating the amount of sodium arsenite in a dip fluid the result is generally given in terms of arsenious oxide (As_2O_3), which is the oxide corresponding to that salt. In this article, besides giving the amount of sodium arsenite in a fluid, the total quantity of the sodium arsenite and the sodium arsenate, together, is estimated as well, but in order to make the results more readily comparable, the latter is also given in terms of arsenious oxide and is designated as "total arsenic" in the tables.

In the *Journal of Agricultural Science* for October, 1911, there appeared an article by Messrs. W. F. Cooper and G. A. Freak on "Oxidation of Arsenites to Arsenates in Cattle Dipping Tanks." In this the authors quote that J. C. Brünnich, in a paper read before the Australian Association for the Advancement of Science, 1909, had traced the loss of arsenite in dipping tanks to the oxidation of the arsenite to arsenate, and that this oxidation was greater in the presence of tar products, and, further, that stockholm tar induced oxidation more readily than carbolic acid.

In order to test further these experiments of Brünnich, a series of investigations were afterwards conducted by Messrs. Cooper and Freak to compare the relative effects of wood tar and commercial cresylic acids. The results of their work are given in the above-mentioned article, of which the following is a summary of the conclusions arrived at:—

1. Oxidation of arsenites to arsenates takes place in the presence of wood tar and also of cresylic acids. The oxidation, however, in presence of wood tar is considerably greater than that which occurs in case of cresylic acids.

2. In experiments which were conducted with the solutions exposed throughout to direct sunlight, the extent of oxidation was very much greater than in the cases where the experiments were carried out in the winter, with the vessels also kept out of the direct rays of the sun. But in the vessels exposed to the sun's rays a larger amount of the tar products was also present, and it is difficult to say whether the increased oxidation in these vessels is due to the greater amount of tar products, or to the more actinic power of the sunlight, or to a greater volume of air having perhaps been drawn through the solutions.

In December, 1911, a circular was issued by the U.S.A. Department of Agriculture, entitled "The Spontaneous Oxidation of Arsenical Dipping Fluids" (by Aubrey V. Fuller), giving the results of the analysis of various dips prepared by boiling a mixture of

arsenious oxide with an excess of sal soda, and, after cooling, adding pine tar. With these dips it was shown that rapid oxidation took place in each case, until after about four months the quantity of arsenite present in a vessel would be only about one-tenth, or less, of the amount at the commencement; but in all cases it was proved that the total arsenic remained unaltered in each vessel, thus proving that the loss in the arsenite was really due to its oxidation to arsenate.

In searching for the cause of this oxidation it was incidentally proved that it was not directly due to the presence of the pine tar, but that the mischief was caused by the action of bacteria present in dip fluids under natural conditions. Although the specific organism was not isolated by this experimenter, it was conclusively shown that no oxidation took place in a sterilized medium, but that as soon as there was added to some dip fluids, previously showing no oxidation, a little of the dip from other vessels, in which oxidation had already taken place, then the former also rapidly exhibited the same phenomenon. Further, it was found that the pine tar played no essential part in the reaction, but the author suggests that possibly the organisms gained access to the tanks through one or more of the following channels:—(1) The water used in preparing the dip; (2) through the air; and (3) by the excrementitious or other matter derived from the cattle passing through the dip.

Having thus summarized the investigational work hitherto published on this subject, I wish to give in detail the results of the experiments carried out in connection with the subject in the laboratory at Cedara during the past half-year.

The method adopted for the estimation of the amount of arsenite present was as follows:—To the dip fluid a few c.c. of concentrated sulphuric acid was added and the flask warmed for a short time in order to precipitate most of the organic matter present. After filtering, the dip was titrated with a standard solution of iodine, as usual.

In estimating the *total* arsenic, the dip fluid, after filtering, was treated with concentrated hydrochloric acid and potassium iodide in order to reduce all the arsenic present. The free iodine was then got rid of and the solution neutralized, previous to titration with the standard iodine.*

First Series of Investigations.

These were conducted with the view of comparing the rates of oxidation in dips under varying conditions.

The first dip fluid was made up of sodium arsenite in pure water, of the same strength as is usually used in seven-day dips. The second dip contained excretory matter in addition, but otherwise was similar to the first. The third was made up according to the "Laboratory" formula, containing paraffin and soft soap in addition to sodium arsenite, and to which some excretory matter was added as well. Each dip was analysed immediately after it was prepared

* The writer is aware that the above methods leave something to be desired in the way of rigid accuracy owing to the absorption of some iodine by the small quantity of organic matter present in solution; but blank experiments showed that this absorption was really comparatively unimportant under the conditions prevailing in these methods of estimation. Moreover, as only comparative, and not absolute, figures were chiefly required in these investigations, the slight inaccuracy in the analytical results does not vitiate the conclusions drawn from them.

and also at the end of every month, the liquids being kept in stoppered bottles in the laboratory.

The analytical results are tabulated below:—

Table I.—Dip Fluid made up of Sodium Arsenite in Pure Water; prepared on 4th June, 1912.

	First Analysis.	After 1 month.	After 2 months.	After 3 months.	After 4 months.	After 5 months.
	%	%	%	%	%	%
1. Amount of Arsenite (calculated as Arsenious Oxide)	0·165	0·166	0·165	0·165	0·165	0·165
2. Total Arsenic (calculated as Arsenious Oxide)	0·168	0·169	0·167	0·168	0·168	0·168

Table II.—Dip Fluid composed of Sodium Arsenite in Spring Water, with Excretory Matter; prepared 4th June, 1912.

	First Analysis	After 1 month	After 2 months.	After 3 months.
	%	%	%	%
1. Amount of Arsenite (calculated as Arsenious Oxide)	0·164	0·109	0·001	Trace
2. Total Arsenic (calculated as Arsenious Oxide)	0·168	0·170	0·170	0·170

Table III.—Dip Fluid prepared according to "Laboratory" Formula, with Excretory Matter; prepared 3rd June, 1912.

	First Analysis.	After 1 month.	After 2 months.	After 3 months.	After 4 months.	After 5 months.
	%	%	%	%	%	%
1. Amount of Arsenic (calculated as Arsenious Oxide)	0·165	0·164	0·121	0·050	0·027	0·005
2. Total Arsenic (calculated as Arsenious Oxide)	0·170	0·174	0·175	0·173	0·171	0·171

In the first dip it is evident that no oxidation whatever of the arsenite took place, but the addition of excretory matter, as in the case of the second dip, caused such rapid oxidation that within two months practically all the arsenite had disappeared. With the "Laboratory" dip, containing excretory matter as well, the conditions were also favourable for rapid oxidation, and the action was practically complete in five months.

It will be noticed that within the limits of error of analysis, and allowing for any possible evaporation of water that may have taken place, the amount of total arsenic remained constant in each sample.

Second Series of Investigations.

These were carried out in connection with a proprietary arsenical dip, with which the dipping tank on the Cedara Experiment Farm

was filled on 22nd May, 1912. Immediately the dip fluid was prepared, a sample was taken and the amount of arsenic in it estimated, the remainder of the sample being kept in a stoppered bottle in the laboratory and analysed at intervals of one month.

The fluid in the dipping tank was subject to the ordinary conditions prevailing on a farm, but care was taken that for the next two or three months no additions of any ingredients were made to it. This period coincided with the winter season, so that the amount of evaporation was below the average, and the temperature of the fluid in the tank frequently went down at night-time to near freezing point—in fact, it is probable that this temperature was reached at times.

At intervals of a month samples of the fluid were drawn from the tank and immediately analysed. The remainder of the sample, in each case, was also kept in the laboratory in closed vessels and analysed every month.

Table I.—Fluid taken out of Dipping Tank on 22nd May, immediately after its preparation.

	First Analysis.	After 1 month.	After 2 months.	After 3 months.	After 4 months.	After 6 months.
	%	%	%	%	%	%
1. Amount of Arsenite (calculated as Arsenious Oxide)	0·172	0·164	0·161	0·156	0·149	0·143
2. Total Arsenic (calculated as Arsenious Oxide)	0·176	0·174	0·177	0·178	0·177	0·176

Table II.—Fluid taken out of Dipping Tank on 22nd June, after being in tank for one month.

	First Analysis.	After 1 month.	After 2 months.	After 3 months.	After 4 months.
	%	%	%	%	%
1. Amount of Arsenite (calculated as Arsenious Oxide)	0·134	0·120	0·072	0·009	0·003
2. Total Arsenic (calculated as Arsenious Oxide)	0·147	0·147	0·148	0·148	0·145

Table III.—Fluid taken out of Dipping Tank on 25th July, after being in tank for two months.

	First Analysis.	After 1 month.	After 2 months.	After 3 months.	After 4 months.
	%	%	%	%	%
1. Amount of Arsenite (calculated as Arsenious Oxide)	0·132	0·132	0·132	0·132	0·129
2. Total Arsenic (calculated as Arsenious Oxide)	0·148	0·151	0·151	0·151	0·151

Table IV.—Fluid taken out of Dipping Tank on 10th August, after being in tank for two and a half months.

	First Analysis	After 1 month.	After 2 months.	After 3 months.
	%	%	%	%
1. Amount of Arsenite (calculated as Arsenious Oxide)	0·134	0·131	0·129	0·127
2. Total Arsenic (calculated as Arsenious Oxide)	0·154	0·154	0·153	0·153

From a careful comparison of the data given in the above tables, and bearing in mind the conditions prevailing at the time the experiments were carried out, one is justified in advancing the following conclusions:—

1. The large decrease shown in the amount of arsenic in the dipping tank during the first monthly interval after it was prepared, is probably only apparent. The first sample was taken immediately after the dip was made up, and it is more than likely that the fluid was not uniform and thoroughly mixed in the tank at the time.

2. Table I shows that the fresh sample from the tank only undergoes a comparatively slight progressive decrease in arsenite on standing in the laboratory; evidently there were very few bacteria present in the fluid at the commencement, and the fresh medium cannot be very favourable for their multiplication.

3. The results given in Table II first demonstrate clearly that oxidation had proceeded fairly rapidly in the tank during the first month, for there is a greater difference between the two figures in the first column of Table II than between the figures in the corresponding column of Table I.

Another outstanding feature of these figures is the rapid decrease shown to have taken place in the strength of the arsenite during the period the fluid was standing in the laboratory. The bacteria had evidently fairly established themselves during the first month the dip fluid was in the tank, and the moderately high temperature of the laboratory must have favoured their increase.

4. It is apparent from the results in Table III that very little oxidation had taken place in the tank during the month of July, and it is reasonable to presume that the low temperature prevailing throughout that period was unfavourable to bacterial activity. Further, seeing that no further oxidation took place in this sample during the succeeding few months, while being kept at a medium temperature in the laboratory, it seems as if probably all the organisms in the dipping tank had been killed off. It may be mentioned also that very little dipping took place on this farm during the month of July, so that the liquid was less subject to fresh sources of infection.

5. The results of the analyses of the sample taken from the tank of 10th August show that no further oxidation had proceeded throughout the first portion of that month, during which the temperature also remained low. That the dip fluid in the tank had probably again become slightly infected is shown by the fact that this sample gradually lost strength in arsenite during the next few months while being kept in the laboratory.

The above data fully bear out Cooper and Freak's conclusions that the oxidation is far more rapid in the warmer summer months of the year than in the winter, owing to the greater activity of the bacteria at the higher temperatures.

All experimenters with dips are agreed that sodium arsenate is much less efficacious as an insecticide than the corresponding arsenite, so this question is seen to be of vital importance to stock breeders who have to dip their animals periodically. It is very essential that they should have the contents of their tanks analysed regularly, in order to have estimated the amounts both of the arsenites and arsenates in the fluid.

Whether means could be devised to moderate this oxidising action brought about by organisms in a dipping tank is very doubtful—one can almost say impossible—but it is a question that urgently needs further investigation at the hands of the trained bacteriologist.

Another problem that awaits solution, as far as I am aware, is the comparative lethal effects of the arsenite and arsenate of soda on ticks. This would enable the chemist to have a more definite idea of the strength of a particular dip submitted to him for analysis and to advise with a greater degree of confidence as to the proper quantity of either insecticide or water to add in order to bring the fluid in the tank to normal strength. Up to the present we have been only concerned with ensuring that the proper amount of arsenite was present, entirely neglecting the arsenate, although there may have been sometimes a comparatively large quantity of the latter also in the dip fluid, and which has a distinctly good effect as a tick-destroying agent.

I would take this opportunity of emphasizing the necessity for farmers to satisfy themselves that the arsenite of soda procured by them comes up to the usual guarantee of 80 per cent. arsenious oxide. Samples analysed in this laboratory have ranged in strength from approximately 74 per cent. up to a little over 80 per cent. Furthermore, seeing that errors may also arise in weighing out the arsenite of soda, and because of the difficulty of measuring the volume of the water with sufficient degree of accuracy, it is very desirable that an analysis of the dip fluid be made as soon as it is prepared and thoroughly mixed in the tank. In conclusion, in view of the facts brought to light in this article, it is hardly necessary to mention that a periodical estimation of the arsenical contents of the dipping tank is very essential, and that stock owners would run grave risk in neglecting to take this wise precaution.

The Preservation and Use of Maize for Stock Feed.

By JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

(Continued from Page 853.)

THE FEEDING OF SILAGE.

MUCH waste of good silage often takes place through ignorance of the fact that it spoils quickly if left exposed to the air; the advent of fresh oxygen facilitates decomposition. To prevent this waste a certain amount of the exposed surface must be removed regularly each day after the pit has once been opened. With a rectangular pit a better check can be kept on the amount of surface exposed than with a circular pit. In opening the pit it is customary to begin to remove the soil for a width of about 6 ft. at one end, and to feed the material from this space until the bottom is reached; this leaves room to work. After this a portion of not less than 2 in. thick is removed from the exposed surface every day, and no more is uncovered than can be treated in this way. Chopped silage is usually filled into bags, and is then easily carted to the place where it is required.

Care should be taken when the feeding with silage is commenced; if fed indiscriminately it may cause scour. The quantity should be small for a few days, and increased gradually. Chopped silage can be conveniently mixed with mielies and bran when the latter are also used. If silage is fed in the open, only put out as much as will be consumed daily, as it is likely to deteriorate if exposed to the atmosphere for a lengthened period (*Holm*).

The character of silage is such that, even though cows seemingly thrive on it even when fed alone, some dry roughage should be supplied with it (*Henry*). As maize silage is rich in carbohydrates and low in protein content, the complementary roughage should preferably be a nitrogenous food, such as lucerne hay, cowpea hay, velvet bean hay, or peanut hay; even teff hay, though not as rich in protein as these, may be used with advantage.

Good maize silage always contains a liberal supply of ears, and the amount to be fed depends directly upon the proportion of ears to forage. From 30 to 50 lb. is the usual daily allowance for a cow (*Henry.*)

IMPORTANCE OF A "BALANCED" RATION.

Ingle has pointed out the danger of feeding draught animals upon an exclusive diet of cereals, because such diet does not adequately supply the needs of animals with respect to bone-forming materials, especially lime and phosphoric acid. The value of foodstuffs is usually

based on the proportions present of the three following classes of constituents:—

(1) proteids or albuminoids (i.e. nitrogenous substances);
(2) carbohydrates (e.g. starch and sugar); and
(3) ether extract or fatty substances.

To secure satisfactory results in stock-feeding, it is necessary to supply these three classes of materials in proportion suitable to the special requirements of the animals being fed. The proportion of nitrogenous to non-nitrogenous materials is known as the "*nutritive ratio.*" This ratio is approximately fixed (within certain limits) for different classes of animals under different conditions, and it is found that one cannot exceed these limits and secure the most satisfactory results.

Ingle gives the following figures as representing what have been found by experiment to be the most suitable nutritive ratios in the rations for various purposes:—

For very young animals	1: 4.0
,, oxen at rest	1: 11.0
,, oxen moderately worked	1: 7.5
,, oxen heavily worked	1: 6.0
,, horses moderately worked	1: 7.0
,, horses heavily worked	1: 5.5
,, cows giving little milk	1: 6.0
,, cows giving much milk	1: 5.0
,, sheep for wool production	1: 8.0
,, fattening sheep, cattle, and pigs	1: 5.5
,, laying hens or ducks	1: 4.0

Ingle points out that working horses or mules fed upon an exclusive diet of mielies and oat-hay are receiving either too little nitrogenous matter for their requirements, or, if they eat more of their food, are taking more fats and carbohydrates than they require. This is undoubtedly a wasteful method of feeding, therefore, and is also very liable to injure the health of the animals. Ingle recommends not the reduction of the amount of mielies, but the substitution for a portion of the oat-hay of some foodstuff with a "narrower" albuminoid ratio, i.e. of some product richer in nitrogenous material, such as teff-grass hay, lucerne hay, velvet-bean hay, maize forage, maize stover, soybeans, peas, beans, peanut hay, or the various oilcakes. In other words we should not—as we are too apt to do—run to the extreme of condemning maize grain because it is too "broad" a ration to be used alone, but narrow it down by the addition of suitable balancing material.

Some "Nutritive Ratios."—Ingle has also given the following list of nutritive ratios:—

Maize (bread or flour maize, Transvaal grown)	1: 9.6
Maize (dent, Transvaal grown)	1: 9.2
Maize (flint, Transvaal grown)	1: 8.0
Kaffir corn	1: 8.2
Oat grain	1: 6.0
Wheat grain	1: 6.4
Barley grain	1: 6.0

Buckwheat	1: 6.1
Millet (grain)	1: 5.7
Linseed	1: 5.1
Peas	1: 2.7
Soybeans	1: 2.0
Horsebeans	1: 2.0
Cowpeas	1: 2.8
Linseed cake	1: 2.0
Cocoanut cake	1: 3.2
Peanut cake	1: 0.9
Bran	1: 3.6
Lucerne hay	1: 2.3
Teff-grass hay (Transvaal grown)	1: 7.7
Boer-manna hay (Transvaal grown)	1: 10.1
Natal blue-grass hay	1: 10.2
Rhodes grass (Transvaal grown)	1: 3.5
English meadow-hay	1: 4.9

MIXTURES TO INCREASE THE FEEDING VALUE OF MAIZE SILAGE.

To give more "balance" to the ration of maize silage some nitrogenous material should be added. Where concentrated foodstuffs, such as linseed meal, peanut meal or soybean cake are cheap, they can be added to the daily ration of silage. But many farmers will probably find it more economical to grow a leguminose crop which can be cut up and mixed with the maize in the silo. There are several leguminose crops which can be given in the summer season and cut up to mix with the maize crop in the silo. These include:—

Velvet beans (*Mucuna utilis*).—A bushveld and low-country crop, rather slow of growth, but giving a remarkably heavy yield. The seed should not be planted until the ground is warm. It is usually planted in rows 4 ft. apart, with two or three seeds dropped every 2 ft. in the row. Sometimes the velvet bean is planted with the maize for silage, but this may interfere somewhat with the cleaning of the crop.

Cowpeas or kaffir-beans (*Vigna Catjang*) form a valuable crop for silage or for hay. In cold soils the seed is apt to rot if planted before the ground is warm. The principal drawback to the cowpea as a farm crop is the difficulty of thrashing the seed, as the pods do not open easily. In the Southern States, where it is largely grown for stock-feed, farmers usually shell out only enough to plant their own crop; the seed is particularly subject to weevil. For these reasons it is both scarce and costly, but there is generally a limited supply on the local markets. A good plan is to sow cowpeas broadcast among the mielies at the time of the last (say the fourth) cultivation. This adds to the feeding value of the stover or fodder and helps to check the weeds from seeding.

Velvet beans and cowpeas are usually cut for silage when the beans are somewhat grown in the pod. But the velvet bean is often rather late in coming to maturity, being a slow-growing crop, and it may be necessary to cut it in the flowering stage.

The hyacinth bean (*Dolichos Lablab*) is another admirable fodder crop.

Peanuts or monkey nuts (*Arachis hypogaea*).—When grown for the "nuts," the straw can be used in the silo, but the crop is too light to be grown specially for silage.

Soybeans (*Glycine hispida*) can be used for silage, but the crop is too uncertain, at present, to be relied upon, and is less satisfactory than either velvet beans or cowpeas.

Sugar beans (*Phaseolus vulgaris*) could be used for silage; the running sorts would be preferred as giving a greater yield of fodder.

Lucerne (*Medicago sativa*) can be cut green and used to add nitrogenous matter to the maize silage, and can be used advantageously in this way if the weather is not suitable for making lucerne hay. The lucerne is probably in the best condition for ensiling when it is beginning to flower.

KINDS OF SILAGE.

Silage may be either "sour" (green) or "sweet" (brown). The difference depends on the degree and kind of fermentation, and this, again, is regulated by the temperature. If the temperature is allowed to rise above 130° F. sweet silage results; it it reaches 150° F. it becomes "brown": and if it gets to 160° F. and over it becomes what is known as "burnt" silage, which is undesirable. If the temperature does not exceed 120° F. the silage will be green or sour. Sour silage is found to keep better than sweet after the silo or stack is once opened for use. When the stock have been fed on sour silage for a few days and become accustomed to it, they are said to prefer it to "sweet." But "sour" silage is apt to leave an unpleasant odour about the premises. The best silage is probably that which is intermediate between the sour and sweet stages (*Holm*).

COMPOSITION OF MAIZE SILAGE.

Russel has studied the chemical changes taking place during the ensiling of maize, and finds that the main groups of compounds found in maize silage are fatty acids, hydroxy-acids, amino acids, basic diamino acids, purin bases, and other bases, besides the ordinary constituents of the plant cell, the celluloses, protein, etc. The non-nitrogenous acids are not found in maize at the time of cutting, and the nitrogenous acids, though they are found, occur to a smaller extent than in silage.

The characteristic silage changes are the disappearance of sugar, of some less resistant celluloses and of part of the protein, and the formation of the bodies enumerated above.

Three agents appear to be involved in making silage—the living maize cell, the enzymes, and micro-organisms. It is considered that the two former bring about the primary and essential changes, the latter only secondary and non-essential changes.

The formation of acetic and butyric acids appears to be a respiration effect, and comes about when the living cell is deprived of oxygen. Sugar disappears during the process.

The decomposition of the protein and nucleo-protein is effected by enzymes present at the time of cutting the maize, which can go on acting in the silo even after the cell is dead. Characteristic products of protein-hydrolysis were identified in the silage.

These are regarded as the primary and essential changes.

Bacteria are, however, always present, and attack the less resistant celluloses, the products of protein-hydrolysis, and no doubt other substances as well, but not the resistant fibre. Typical products of bacterial activity were found—formic acid, higher fatty acids, humus, and amines.

The growth of mould is inhibited except at the surface layer where air gets in. Here the changes are fundamentally different—there is no development of acetic or butyric acids, the mass is alkaline, non-protein material already existing in the maize is converted into protein, and there is also a loss of nitrogen.

POPULAR OBJECTIONS TO SILAGE.

One sometimes hears objection raised to the use of silage, on the ground that it makes the milk taste. When such is the case it is because sufficient and suitable care has not been taken with the feeding. Neither the flavour nor the odour of the silage *pass through the body of the cow* to the milk, but are acquired from bits of silage scattered about during the feeding. On this account the silage should be fed immediately *after* milking, so that any odour which may have been disseminated through the cowshed may have disappeared before the next milking time, thus preventing the absorption by the milk of any undesirable flavour.

BEST BREEDS OF MAIZE FOR SILAGE.

Any variety or breed of maize may be grown for silage. It is true that some are more suitable than others, being more leafy and succulent or producing a greater weight of fodder per acre. Of these, one of the best is the *Red-cob ensilage*, a late maturing white dent variety, very drought-resistant, wind-firm (not easily blown over), producing a heavy mass of foliage; cobs large, 14-18 rowed; grain white, fairly hard, bright, rough; core red and fairly thick.

Brazilian flour corn and the Transvaal brood-mielie are useful sorts for fodder and silage, producing good stooling plants and a heavy weight of greenstuff per acre.

Yellow cango is grown for silage by some farmers. It is considered by some to be more subject to stalk-borer than the dent sorts.

Some successful dairy farmers on the Transvaal high veld grow Natal yellow horsetooth for silage, as it is a vigorous grower and good yielder; it is somewhat late in maturing and is therefore planted fairly early (November). Some farmers, again, prefer Natal white horsetooth, the choice depending largely on the sort which does best in a particular locality.

In farm practice it is found that too much labour and expense are involved in keeping a special sort of maize for silage, as the silage crop is not allowed to ripen seed which necessitates the growing of a special seed plot to furnish seed for the next year; this also involves the danger of crossing the grain sorts. It is customary, therefore, to plant for silage the same breed that is grown for grain, the extra weight of stuff being obtained by closer planting.

Some of the ordinary breeds, such as Hickory King, have developed strains with a habit of *stooling* (i.e. branching from the base) which are better suited for silage than the unbranched strains, but here again the difficulty of maintaining the supply of seed has to be faced.

PLANTING DISTANCE FOR SILAGE OR FODDER MAIZE.

The object being to get as heavy a yield as possible from each acre of ground, and as it is not intended to allow the grain to ripen, the plants may stand much closer than is the case where grain is to

be harvested. At the Botanical Experiment Station, Groenkloof, we keep the rows the same distance apart as when we plant for grain (i.e. 3 feet 6 inches), but drop the seed every 5 or 6 inches instead of 18 inches. But no definite rule can be laid down, because so much depends on the local conditions of soil and climate and the particular breed grown. The Pennsylvania and Michigan Stations find the most satisfactory distance to be rows 40 inches apart and single stalks 3 to 9 inches apart in the row.

In the Standerton District (Transvaal) Messrs. Hutchinson & Shaw (Val Station) leave 3 feet between the rows and plant 10 inches apart in the row, and cultivate just as they would for grain, but they are not sure that 2 feet 6 inches by 10 inches would not give a better yield, though "if planted too thick the bottom leaves die," and the leaf is the most valuable part of the fodder. They use Natal yellow horsetooth, a vigorous grower, which could not be grown as thickly as some other sorts; they plant 14 to 15 lb. of seed per acre.

BEST CONDITION OF THE CROP FOR HARVESTING.

The stage of maturity of the crop affects considerably the total yield of dry matter; also the difference in nutritive value at different stages is shown by analyses to be considerable. It is, therefore, important to know the right stage of development of maize intended for grain, stover, fodder, or silage.

In some fodder plants the feeding value increases gradually up to a certain stage of growth, but begins to decrease *before* the plant reaches full maturity, due in part to the transfer of nutritive matter from the leaves and stems to the seed, and in part to the loss of some of the leaves themselves.

In the case of the maize plant, however, both the total amount and the feeding value of the dry matter increase up to—or nearly up to—the stage of complete maturity. The increase in percentage of starch and of soluble carbohydrates is rapid during the development of the ear, and a coincident decrease in proportion of crude fibre occurs.

After ripening there is a considerable loss of dry matter, partly due, no doubt, to loss of the lower leaves on drying off. The Iowa Station found that two months after ripening, under ordinary field conditions, the crop had lost about *one-half* of the dry matter and more than half of the feeding value. The Kansas Station obtained the following yields at different stages of maturity:—

	Yield per Acre.	
	Grain (bushels).	Fodder (tons).
Cut in the "milk" stage	35.5	2.4
Cut in the "dough" stage	51.0	2.4
Cut when ripe	74.0	2.7

The experiments conducted by several other stations show general agreement with these results.

In some instances, however, the yield of the whole plant has been found to decrease slightly in weight of water-free substance during the last one or two weeks of development, doubtless due to loss of leaves.

The plant, *exclusive of the ear*, may decrease materially in weight owing to translocation of material to the grain. At the Iowa Station this decrease was found to equal 17 per cent. of dry matter during the three weeks from the time most of the ears were dented (but leaves

and husks were still all green) until the plant was entirely ripe (Bulletin No. 21). This was perhaps partly due to loss of leaves, but chiefly to translocation of material.

When the maize plant is in full tassel it has developed one-third to half its weight of water-free substance. When it is in the roasting-ear stage three-fourths to four-fifths of its dry matter has developed; when at the silage stage it has developed from three-fourths to nine-tenths of its dry matter (Ill. Bull. No. 31, p. 361; Mich. Bull. No. 154, p. 283; Cornell Bull. No. 4, p. 52).

The greatest rate of growth in height precedes that of the development of dry matter (*Hunt*).

The feeding value of maize fodder at different stages, as determined by milk production, has been investigated by the Pennsylvania Station (Report 1892) and the Ohio State University (D. A. Crowner, Thesis, 1896, quoted by Hunt). The fodder was cut at three different stages of maturity—the roasting-ear stage, the silage stage, and when ripe or nearly so. The weight of field-cured fodder increased with the stage of ripeness, the increase being greatest during the first interval. The percentage eaten was least in that cut early, though prepared with a feed cutter. Compared with the earlier cutting, the intermediate stage gave the greatest increase of milk and of live weight. Compared with the later cutting the difference was less marked.

It is evident, therefore, that the maize crop should not be cut very early, whether intended for grain or for fodder or silage, nor, on the other hand, should it be allowed to stand in the field after ripening if it is desired to obtain the maximum yield of both grain and fodder. When the grain is in the "dough" stage, or even a little harder, it makes excellent silage, especially if passed through a chaff-cutter.

BEST STAGE OF GROWTH FOR GRAIN AND STOVER.

The total yield of grain increases up to the period of full maturity (*Hunt*). When the plant is grown for ears alone it is not only allowed to ripen, but the ears are allowed to remain on the standing stalks until they have become dry enough to be placed in storage, which usually requires about a month after the maize is ripe or after the first killing frost. But when it is intended to harvest the stover as well as the grain it is found desirable to allow the plant to become as ripe as is possible without the leaves falling off before or during the operation of shocking. The ears should be all, or nearly all, dented or glazed, the husks dry, and the leaves from one-third to one-half green (*Hunt*).

BEST STAGE OF GROWTH FOR FODDER.

It is usually considered that the fodder stage is reached when the lower leaves have turned yellow but have not become dry, while the husks on the ears are still green; the grain should be fully glazed and practically mature; in this stage it has been found to give about the heaviest yield without loss of palatability, and be in a suitable condition to "shock" without danger of becoming mouldy. Some farmers recommend that the stalks and the leaves above the ears should have begun to turn golden; but as the whole crop cannot be cut at once it would probably be best to begin in the earlier stage of development, i.e. when the lower leaves have turned yellow but the upper are still green.

When it is desired to secure feed of very high palatability, as for instance for young growing stock or animals being fattened for market,

it is considered desirable to cut it rather earlier, i.e. when the lower leaves have just begun to turn and the ears are in the "roasting" stage *(Hunt)*.

Maize fodder cured in the field has been found to lose from 19 to 21 per cent. of dry matter. The loss is nearly 5 per cent. less if the fodder is cut in the green mielie stage than if cut when nearly ripe, apparently owing to the large amount of soluble carbohydrates present in the latter stage.

BEST STAGE OF GROWTH FOR ENSILING.

The degree of maturity and the condition of succulence are the important factors in deciding when the crop is ready for ensiling. It is impossible to provide a hard and fast rule on these points, as so much depends on local and seasonal conditions. Local experience based on careful observation is therefore the best guide.

Generally speaking maize for silage should be cut rather greener than for fodder, otherwise it does not pack so well in the silo, too much air is left in the mass, and it is apt to mould. Hunt describes the best condition as being reached when many, but not all, the ears have become dented in the grain, a portion of the husks dry, and the bottom three or four leaves dry, with the rest still green. Until this stage has been reached it may be considered that the greener the maize the greater the loss in the silo. He summarises as follows the advantages of allowing the crop intended for silage to arrive at the stage of maturity indicated above:—

(1) Greater yield of water-free substance.
(2) Less total weight to handle.
(3) Less loss in silo.
(4) Superior composition.
(5) Greater digestibility.
(6) Greater palatability, resulting in a greater feeding value per acre at less cost.

The following table prepared by Hunt at the Cornell Station shows the influence of maturity upon weight of fresh and dry substance and loss in the silo:—

Date of Cutting.	Green Matter per acre.	Dry Matter. Per acre.	Dry Matter. Per cent. Green Food.	Dry Matter in Silage; loss per acre.	Condition of Maize.
	lb.	lb.		lb.	
Aug. 10	19,200	2,672	13·1	752	In full tassel.
„ 16	20,800	3,144	15·1	502	Maize in silk.
„ 22	21,840	3,712	17·4	305	Grains fully formed.
„ 28	19,200	3,744	19·5	288	Grains in milk.
Sept. 3	16,960	3,824	22·5	195	Grains still in milk.
„ 9	16,300	4,168	25·3	188	Grains past milk.
„ 14	14,720	4,536	30·8	125	Maize glazed.

If put into the silo before the grain has reached the "glazed" or "roasting" stage the silage is less nutritious than it would otherwise be and is apt to be unduly acid. If, on the other hand, it is allowed to get riper than the "glazed" stage it is less likely to pack well, and

mouldy spots or masses will be found among the silage. The over-acid condition is due to excessive succulence and the mouldy condition to lack of succulence. A partial remedy for the first trouble is to wilt the maize more or less before putting it into the silo. For the mouldy condition, prevention is the best remedy—the maize should be cut rather younger. If, however, it has already become a little too old before it has been practicable to cut it, the condition may be improved by pouring a little water over the mass while the silo is being filled, or by adding a little succulent material such as green lucerne, velvet beans, cowpeas, or soybeans. The amount of wilting required for immature maize depends on the degree of succulence, and must be learned by experience—the younger the plants the more they must be wilted.

Frosted Maize.—The value of maize for silage is reduced by freezing, but if the crop is cut and put into the silo immediately after being frosted the value of the silage made from it, though reduced, is not seriously impaired. But if allowed to stand uncut for any length of time after being frost-nipped it is greatly injured for feeding.

COMPOSITION OF MAIZE AT DIFFERENT STAGES OF MATURITY.

The following analyses furnished by the Maine Station (Report, 1893, pt. 2, p. 25) show the variation in composition of the maize plant at various stages of growth. The percentages are those of water-free matter. These analyses were made at the Maine Experiment Station, and have been generally verified at other stations (*Jordan, W. H.*: "The Feeding of Animals," p. 211).

Stage of Growth.	Protein.	Sugar.	Starch.	Total nitrogen-free extract.	Fat.	Ash.	Crude Fibre.
Very immature (Aug. 15) ...	15·0	11·7	---	46·6	2·6	9·3	26·5
A few roasting ears (Aug. 28)	11·7	20·4	2·1	55·6	2·9	6·5	23·3
All at roasting-ear stage (Sep. 4)	11·4	20·6	4·9	59·7	3·0	6·2	19·7
Some ears glazing (Sep. 12)...	9·6	21·1	5·3	62·5	3·0	5·6	19·3
All ears glazed (Sep. 21) ...	9·2	16·5	15·4	63·3	3·0	5·9	18·6

Though there is nearly 6 per cent. less protein in the glazed stage, there is an increase of nearly 17 per cent. of nitrogen-free extract and a decrease of nearly 8 per cent. of crude fibre.

DIGESTIBILITY AT DIFFERENT STAGES OF MATURITY.

There is also a variation in the degree of digestibility according to the stage of maturity at which the maize has been cut. Both with silage and fodder the digestibility is higher after the grain has glazed or dented than before. The total digestible food value of the maize crop has been found to be from 200 to 300 per cent. greater in the fully mature crop than in the silking stage, and 36 per cent. greater that at the time the ears were glazing (*Armsby*, Pennsylvania Station Report, 1892).

Jordan ("The Feeding of Animals," p. 212) gives the following summary of experiments on the digestibility of maize fodder and

silage; the figures show the amount digested out of one hundred parts of organic matter:—

	Maize Fodder.			Maize Silage.		
	Max.	Min.	Av.	Max.	Min.	Av.
Cut before glazing: 13 experiments	71·4	53·6	65·7	77·8	56.6	67·4
Cut after glazing: 10 experiments	74·2	61·2	70·7	80·2	65·2	73·6

The average difference in favour of the more mature crop is thus 5 per cent. in the case of fodder and 6 per cent. in the case of silage.

HARVESTING MAIZE FOR FODDER, STOVER, OR SILAGE.

The cutting of the maize crop may be done by means of a cane-knife, such as is used in Natal for sugar-cane, or the corn-knife used in the States. But modern machinery, such as the "Maize Cutter" and "Maize Harvester," have been devised and constructed to minimize the labour and cheapen the cost of production of maize fodder. There is also a machine on the market which both cuts and shocks the maize at one operation.

Where the maize is check-rowed and two or three plants stand at a "hill" it is customary to put the stalks from 10 by 10 hills together into one "stook" or "shock"; this would equal ten rows and about 30 feet of row where continuous row-planting is practised. "A common method is to tie four hills together without cutting them off and then to shock the rest of the plants around these, while in other cases a wooden horse is used as a temporary support. When the shock is completed a light rope with a hook on one end is used to draw the top of the shock together; it is then tied with twine" or with one or more stalks of maize. The shocks are then left to stand in the field to cure.

It takes about a month to cure the fodder, after which the shocks are gathered together and stacked to prevent loss from frost and winds, or are husked by hand if it is not intended to feed the grain with the fodder.

The "combined husker and shredder" is a useful, if somewhat expensive, labour-saving machine which takes the maize plant direct from the stook, removes and husks the ear, shells the grain, and shreds or cuts up the stover (stalks and leaves) into small pieces. Shredded stover is more palatable and less wasteful than whole stover. It may be stored in the barn or in a stack. In order to keep well the stover must be thoroughly dry at the time of husking. Owing to the capital outlay involved in the purchase of a shredding outfit and the short period of the year for which it is required, few private farmers own one. But the number of itinerant machines is on the increase. These travel from farm to farm husking, shelling, and shredding for a percentage of the crop, or at a fixed price per muid or at so much per day.

Topping.—This is a method which has been practised in some parts of the United States where the stover is required to supply lack

of feed before the maize crop is ripe. The prevailing conditions in South Africa do not call for the practice of this method, because we usually have abundance of feed at the time when the maize crop could be topped. In any case the practice cannot be recommended, for investigations show that topping results in a loss of grain which is "more than the feeding value of the fodder secured" (Mississippi Sta. Bull. 33, 1895, p. 63; Penn. Sta. Rep., 1891, pp. 58-60).

Pulling.—In the Southern States there is a tendency for the maize leaves to dry up before the ears are sufficiently mature, and in consequence it has been customary to strip the leaves from the stalks while they are still green and the ears immature. In the States "fodder pulling is effected, according to latitude and season, from the 1st of August to the middle or even the last of September. When the operator's hands are full of blades and he can hold no more, the quantity is termed a 'hand,' and is bound rapidly with a twist and hung on a broken stalk to cure. On gathering a day or so later, from three to four hands form a 'bundle,' which is also bound with a few twisted blades. The bundle weighs from one and three-fourths to two pounds, and forms the staple 'roughage' of southern draft stock" (*Myrick*). The Georgia Station concludes that the practice is only expedient under the most favourable circumstances, but that where it is done the best method is to strip the blades, from and including the ear blade, downwards, and in a week or ten days to cut off the stalks above the ear. This is more expeditious than the ordinary method, and adds largely to the yield of stover (Bulletin No. 23).

The effect of this "pulling" on the yield of grain has been investigated by eight, at least, of the State Experiment Stations, and the general result shows a loss of 10 to 20 per cent. of grain. The Florida Station finds that the "pulling" of fodder has the effect of loosening the husks in the ear before the grains become hard, thus promoting the ravages of the weevil (Bulletin No. 16, 1892).

METHODS OF ENSILING.

The modern silo is sometimes an elaborate and expensive structure which may cost hundreds of pounds, but good silos can be made in a very simple manner and at small cost. Three methods of preparation are in vogue—stacking, burying in a pit, and preserving in an air-tight chamber. The principle is the same in all cases, i.e. development of a limited degree of fermentation, followed by the exclusion of air to prevent desiccation and to arrest decomposition. The means of attaining these ends is to build up a mass of moist vegetation, which then begins to sweat. If this sweating were allowed to continue indefinitely "spontaneous combustion" would ensue and the mass would be spoiled. The most suitable temperature is from 130° F. to 140° F. To allow the whole mass to reach this temperature it must not be too deep at any one time; to prevent increase of temperature above this point fresh material is added, the added weight tending to compress the lower mass, force out the air, exclude a fresh supply of oxygen, and thus check fermentation. In practice it is not necessary to use a thermometer to determine the actual temperature. If the surface heat becomes so great that one can only with difficulty bear to keep the hand on it, more fodder should be added, or the pit (if filled) should be sealed up; but if it does not get warm it should be kept open a few days, and a little water may be poured on to it.

Addition of Salt.—Silage is greatly improved by the addition of salt. Professor Wrightson recommends the use of 1½ lb. to every ton of the green material. A moderate addition of salt to the fodder increases the activity of the secretion of the animal body juices and their circulation, and consequently increases the consumption of protein in the body. Salt has a stimulating influence on the appetite of the animal, facilitates the passage of the albuminoids from the digestive canal into the blood, and in general increases the energy of the vital processes. The feeding of salt is therefore especially useful with horses, young animals, and milk cows when fed to their full capacity. Another effect of salt is to increase the excretion of urine (*Henry*).

THE MODERN SILO.

The modern silo is usually built of stone, brick, re-enforced concrete, corrugated iron, wood, or whatever material is both efficient and least expensive. It should be air-tight at the bottom and sides, durable, and of such a size that it will hold sufficient material for the needs of the stock. The shape should combine the necessary strength with ease and facility for filling and emptying economically and rapidly "The more compact the silage the better it keeps. The greater its diameter and the more nearly circular the silo the less the resistance of the sides to packing. The deeper the silo the more compact the silage and the less the surface exposure in proportion to the whole mass. A silo should never be less than 24 feet deep; 30 feet is very much better, and 40 feet is desirable where practicable and the capacity desired warrants it" (*Hunt*). A circular silo is usually about 30 feet high and 15 or 16 feet diameter, with a stone or concrete foundation. Doors for the removal of the silage are placed in a row up the sides at 6 or 8 feet apart. Some silos in South Africa have been constructed of double walls of corrugated iron, well braced and hooped together, and are reported as having been quite successful.

"The surface area of the silo should be such that the silage will be fed rapidly enough to prevent decay. It should never be more than ten square feet per cow; five is better, while seven and a half gives good results. The riper the silage the less weight the silo will hold. The higher the silo and the greater the diameter the more weight the silo will hold. The weight and keeping quality will depend also upon the manner of filling. . . . The more slowly the silo is filled the more it will hold. A silo 16 feet in diameter and 30 feet high will hold—when continuously filled with suitably ripened maize—about 33⅓ lb. of silage per cubic foot, or about 100 tons of silage. A cubic foot of such silage is a standard daily ration for a cow in milk. The capacity of the silo required may be calculated in cubic feet by multiplying the number of animals to be fed by the days of feeding desired." The construction of modern silos was described and illustrated by Mr. A. Morrison Hay in Farmer's Bulletin No. 59 of the Transvaal Department of Agriculture.

But at best the silo is an expensive item, and where other and more imperative outlay is required on the farm its construction may well be left till later. In the climate of South Africa, at least the greater part of which enjoys a dry winter, excellent silage can be made either in a pit or in a stack.

THE STACK SILO.

This is built up in the form of a haystack of maize stalks not cut into lengths. Several Transvaal farmers have made stack silage for years, and find it an economical and easy method of preserving winter feed. The principle to be followed in making stack silage is to pack the maize stalks as closely and evenly as possible—a small quantity at a time. Four or five ox-wagon loads per day is sufficient for a moderate stack. This is built up to the required height (usually 10 or 12 feet), and when the required temperature has been reached the stack is weighted down to prevent further increase of temperature. Some farmers use a thick layer of veld hay, which gives the necessary weight and can afterwards be used as bedding. In the bushveld, where wood is plentiful, poles can be used. In other places bricks, stones, and even corrugated iron and soil are used with success. Some bushveld farmers build the silo on timbers laid on the ground with cross-pieces under the ends. A similar arrangement of poles is laid on top of the stack; the upper and lower cross-pieces are connected by chains or strong steel rope and tightened by leverage; this operation is carried out every few days until the mass ceases to settle any more.

In stack silage there is a good deal of waste on the outside of the stack. This may be greatly reduced by paring off the sides and ends every three or four days while it is being built, the parings being thrown into the centre of the stack. Where veld hay is not used some farmers put a layer of wet dung 9 to 12 inches thick to seal up the top of the stack and prevent injury and waste.

THE PIT SILO.

At the Botanical Experiment Station, Pretoria, at the Government Experiment Farm, Potchefstroom, at Messrs. John Fowler & Company's maize farms, Vereeniging, at Major Doyle's farm, Woburn, on the Springbok Flats, and at several other farms, the pit method of preparing silage has been in use for several years. At Potchefstroom it has been customary to make about 150 tons of silage per annum and at Vereeniging about 600 tons. In this climate it proves both economical and effective. These pits are not lined in any way and have no floor other than the solid ground. They are covered with earth and there is no roof over them, so that the cost of preparation of the silo is very small. As the silage is stored during the dry season there is usually no danger of seepage provided a suitable site for the pit is selected; in some localities a catch-water ditch around the upper side of the pit is found desirable. If the pit has perforce to be made in loose soil a lining of corrugated iron or other suitable substance may be found desirable. If there is danger of springs breaking into the pit some provision for drainage may be found necessary. Rectangular pits are preferable to circular ones, because in the former, when opened for use, the silage can be removed in sections without uncovering the whole surface, thus preventing loss from exposure to the atmosphere. Several small pits are preferable to one very large one, because it may be desired to reserve some of them for another year, and there need be no damage to the silage through its having been kept over. But once opened to the air the contents do not keep well.

A pit 25 feet long, 15 feet wide, and 8 feet deep, containing 3000 cubic feet, would hold about 55 tons of silage. If the maize has

been well cut and packed a cubic foot should weigh from 35 to 40 lb. Some farmers put the maize stalks into the pit whole as they would on to the stack, but the usual method is to cut them into lengths of one-half to one and a half inches with a chaff-cutter, which results in closer packing and a better quality of silage; in this form it is more easily removed from the pit, and there is little or no waste in feeding such as there is when the material is left long. The time consumed in cutting is well spent. The pit may be filled as rapidly as the maize can be cut; or the filling may extend over a fairly long period without affecting the quality of the silage. The usual method is to put two or three feet of silage into each pit each day, allowing it to heat and settle for a day or two (not more than three), when another two or three feet may be added. To prevent loss of time two or three pits may be kept going in close proximity, the chaff-cutter being moved from one to the other. For small pits the cutting may be done by hand-power, but horse-gear or steam-power are used for the larger. Much of the success of the work depends on the management of the pit. The fodder should be kept spread evenly over the surface as the cutting proceeds, and exceptional care should be taken to keep the outsides well trodden; if the mass at the edges of the pit remains loosely packed it will become mouldy and unfit for food. When the mass is a few feet deep a mule or horse is kept walking about in the pit to tread it down. If the maize is rather too mature and dry a little water should be thrown over the mass occasionally. The pit is filled to about a foot above the ground level and allowed to settle for a day or two; it is then covered with a layer of soil about a foot deep and evenly spread—to give the necessary pressure and to exclude the air. The pit can be kept indefinitely, or feeding can commence in about two months after closing the pit.

(*To be continued.*)

Tuberculosis of Food Animals and its relation to the Public Health.

By Walter Jowett, F.R.C.V.S., D.V.H., Department of Agriculture (Veterinary Division), Capetown.

Tuberculosis is a disease of world-wide distribution affecting mankind (in which it is popularly termed "consumption") and all the lower animals, especially prevalent in cattle, but of by no means infrequent occurrence in swine. The disease is also, though less frequently, met with in horses, goats, and sheep, as well as in cats and dogs, whilst in poultry and other birds tuberculosis is anything but a rarity.

Nature of the Disease.

Tuberculosis is a contagious disease caused by a definite micro-organism, the bacillus tuberculosis, or Koch's bacillus, and capable of transmission from animal to animal in various ways. Human beings can contract the malady from the lower animals by drinking the milk of infected cows, or by eating food products (butter and cheese, etc.) prepared from infected milk, and also by consuming the flesh of tuberculous animals (cattle, swine, etc.).

Symptoms.

Bovine tuberculosis is a disease of most insidious nature, and only in relatively few instances can its presence in an animal be diagnosed with certainty by physical means alone. It is often a source of wonder to the farmer and cattle owner when well marked evidence of the existence of the disease is demonstrated in the carcass of a bull, cow, or other animal, which prior to slaughter was, maybe, sleek, fat, and in excellent condition; and yet, those who have to deal with the disease are well aware that such cases are by no means of uncommon occurrence.

The disease is generally of slow progress, and in many cases months, or even years, may elapse before obvious signs of the malady become apparent, at any rate to the casual observer. It must be remembered that the lifetime of the average bovine animal is usually of short duration, and in many instances infected animals do not live long enough for well marked outward signs of the disease to be shown.

If the infected animal be subjected to some adverse influence, and its vitality be consequently lowered, the disease progresses more rapidly, and in this event signs of the malady will more speedily become apparent. Amongst such adverse influences, mention may be made of drought, insufficient food, the heavy drain on the system in milk production, parturition, etc. But, as already remarked, many cases show no obvious signs of the presence of the disease, and were it not for the incalculable value and practically unfailing accuracy of a method of diagnosis which we possess, namely, the *tuberculin test*,

many badly infected cases of tuberculosis would pass through life entirely unsuspected of being the subjects of this disease. We shall have occasion to discuss this test (tuberculin test) later in the course of the present article, meanwhile we will refer briefly to those physical signs of the disease which are sometimes manifest, and which may suggest the presence of the disease, and in some cases even permit the expert to diagnose it with certainty, though, as already stated, it is often a difficult matter to make a definite diagnosis in the absence of the tuberculin test.

Tuberculosis may attack almost any organ of the body, consequently we may encounter symptoms especially associated with disturbance of the organ or part affected, as well as general symptoms resulting from the effect of the disease on the body as a whole. One symptom often in evidence in well marked cases where the lungs and respiratory organs are affected is a *cough*. In the early stages this is usually subdued and infrequent, being heard especially when the animal is driven or disturbed, or in the case of stabled animals in the early morning when the byre or cowshed is opened. Later, as a rule, the cough becomes more frequent. The mucus which is coughed up is usually swallowed by the animal; it may, however, be expelled from the mouth and nose in the form of spray. *Diarrhœa*: "Scouring" is seen particularly in cases where the intestines are involved in the disease. Regarding this symptom, there is nothing typical, as it is met with in several other diseases of cattle. It may be mentioned that diarrhœa, the result of tuberculosis, fails as a rule to respond to treatment, still this is also true of certain other cattle diseases in which diarrhœa is a symptom. *Unthriftiness*: In the later stages of the disease, the coat may be rough and staring, and in such cases there may be emaciation—*loss of flesh*—"pining" or "wasting," as the cowman terms this condition. This symptom, associated with diarrhœa and the presence of a cough, would be very suggestive, but, as already remarked, many extensively diseased animals are apparently sleek and in good condition, and cough and diarrhœa may be entirely absent. Such cases, of course, can only be diagnosed by means of the tuberculin test.

TUBERCULOSIS OF THE UDDER.

When affecting the udder the disease usually occurs in one of the hindquarters of the gland. At first nothing unusual may be noticed beyond, perhaps, a little swelling in the upper portion of the affected quarter or quarters. This, however, gradually increases in size until the entire quarter may be involved, when, not infrequently, it then acquires a wooden hardness. Sometimes a number of lumps or nodules may be felt in the substance of the gland. The lymphatic glands ("kernels") situated in the upper and posterior part of the hindquarters are invariably involved in the diseased process and they may sometimes be felt through the skin, being swollen, enlarged, and occasionally nodular. Contrary to what is observed in other forms of mammitis (inflammation of the udder), in which the milk is usually thickened, diminished in quantity, and not infrequently mixed with blood or pus ("matter"), in the case of tubercular mastitis this secretion often remains normal in appearance, at any rate during the early stages of the disease. Later the milk may become somewhat thin and watery-looking, and still later may be diminished in quantity.

POST-MORTEM APPEARANCES.

Evidence of the disease may be found in any of the organs of a tuberculous animal. The lesions may be of an acute or chronic character, and they may be localized (limited in extent) or generalized (spread throughout the organs). Usually in the case of cattle they are chronic and more or less localized.

Recent lesions of the disease appear in the form of small nodules, granulations, or "tubercles," the size of a pin's head or a little larger, semi-transparent or opaque, and of a greyish to yellowish colour. These may be found scattered more or less evenly throughout the substance of an organ, or they may be solitary and isolated. In the older and more chronic lesions larger nodules and conglomerations of nodules in the form of lumps and masses may be encountered. These may be the size of a pea or walnut, or they may be as large as one or both fists, or even larger. These nodules or collections of nodules may be firm and even fibrous in consistency, or, as is often the case, if cut open, the interior may be found yellowish in colour, and either gritty or caseous (cheesy), and in some cases quite soft in the centre. Other lesions of the disease show more or less thick fibrous walls enclosing soft, creamy, semi-fluid contents—one form of these being the so-called tubercular abscesses. The interior of the walls of such lesions is invariably granular in appearance. Older nodules and masses are frequently calcareous and gritty on section, due to the deposition of lime salts—a frequent occurrence in the case of tuberculous lesions in cattle.

The lymphatic glands ("kernels") are often the seat of tuberculous changes—the glands situated between the lungs, and those in connection with the throat, being especially frequently involved. As a rule the tuberculous lymphatic gland is enlarged, and on section one finds "tubercles" in various stages of development in its substance, the surrounding gland tissue being more or less profoundly altered. The more recent tubercles are small, the size of a pin's head or even smaller, and they may or may not show a trace of caseation in their centres. At a later stage confluence of the tubercles and subsequent caseation of the latter may give rise to the formation of irregular caseous masses. In some cases practically the whole of the interior of the gland may be converted into a cheesy or mortar-like mass, or in some instances into a creamy, fluid-like material, in such instances the gland being usually considerably enlarged, and its capsule thickened. Calcification of the tuberculous lesions occurring in the lymphatic glands, as in other organs of the body, is, as already remarked, of frequent occurrence in cattle.

When conducting post-mortem examination on tuberculous animals, one occasionally encounters lymphatic glands showing more or less profound alteration of structure, but in which it may not be possible to demonstrate the presence of distinct tubercles or nodules by naked eye examination alone. In such animals glands which appear enlarged (oedematous or haemorrhagic) must be regarded with suspicion, and further search directed to the detection of distinct tuberculous lesions, either in the lymphatic glands themselves or in the organs with which they are related. The writer desires, however, to direct attention to one form of alteration of the lymphatic glands which is encountered not infrequently in the case of tuberculous animals in this country as elsewhere. The glands which have undergone the alteration now referred to are generally somewhat enlarged,

and on section it is found that the whole of the gland has assumed a uniform grey or greyish-pink colour and granular brain-like appearance. By very careful examination of the cut surface of such diseased glands, one may be able to detect the presence of small granules or nodules, but, on the other hand, these may be so exceedingly minute as to be hardly visible to the naked eye. Inoculation of such glands into susceptible animals has proved their tuberculous nature, and the last described lesions may be taken as representing an early stage of infection of the lymphatic gland with the tubercle bacillus, sufficient time not having elapsed for the formation of well-marked "tubercles" and nodules, or of the other and more characteristic changes which are usually encountered when the disease is of some standing.

The lungs, one or both, are frequently the site of the disease—more frequently, in fact, than any other organ. A few or many tubercles in varying degrees and stages of development may be found in one of the (or both) lungs. They (the lesions) may be small, about the size of a pin's head, or, by confluence, masses of diseased tissue the size of a pea, a walnut, an orange, up to the size of a child's head may be formed. In the small nodules one not infrequently finds a point of caseation in the centre, larger lesions may be found on section extensively caseous or caseocalcareous ("cheese-like" or gritty). On the other hand, the diseased tissue may have broken down to form a creamy, "pus-like" fluid. When the tuberculous lesions are more or less isolated, the surrounding lung tissue may not show very marked alteration; on the other hand, in certain forms of tuberculosis affecting the lungs, it is not uncommon to find well marked inflammatory changes of an acute or chronic nature in evidence. A fairly common form of tuberculosis of the lungs is manifested by the presence of one or several foci of broncho-pneumonia (inflammation of the lung tissue and of the bronchial tubes) showing marked tendency to caseation. Such lesions of tuberculous broncho-pneumonia are greyish red in colour, solid, or semi-solid, of a consistence like spleen (milt) tissue, and of granular appearance. The small bronchial tubes contain muco-pus, and the tissue surrounding the pneumonic patch is somewhat congested and more or less solidified. In the later stages the diseased tissue becomes firmer and fibrous, and of a whitish pink colour. Section of the diseased tissue usually discloses the presence in it of many tubercular nodules, which as a rule have undergone more or less well marked caseation (degeneration with the formation of material of varying consistency, soft and creamy, or dry and firm, and resembling cheese). Sometimes a certain degree of calcification of the lesion (deposition of lime salts in it) may be evident.

In other cases, again, careful examination of both lungs may disclose the presence of but two or three nodules or tubercles, firm, pea-like, and either fibrous, caseous, or calcareous, wholly or in part, the rest of the lung tissue being apparently normal. The adjacent lymphatic glands (bronchial and mediastinal) are commonly involved in the diseased process when the lungs are affected; on the other hand, lesions may be found in these glands when it is impossible to demonstrate the existence of tuberculous alterations of the lungs.

The lining membrane of the chest and abdominal cavity—the pleuro and peritoneum respectively—are rather frequently affected in cattle, in which animals the lesions appear in these membranes in the

form of nodular growths or masses often enclosing caseous (cheesy) points of degeneration, but on the whole being of more or less firm fibrous consistence. Such lesions of the pleura and peritoneum are popularly referred to as "grapes" or as the "pearly disease," from the supposed resemblance which they bear to grapes and their occasional "pearly" appearance.

Tuberculous changes are not infrequently found in the liver, in which case one may encounter a few or many nodules or tubercles scattered throughout the organ, or, as not uncommonly happens, but one, two, or three fairly large lesions, in which softening of the diseased tissue, or caseation, or calcareous changes are evident. The last described lesions in the liver are frequently surrounded by a thick fibrous capsule. When the liver is affected the lymphatic glands in connection with the organ (the hepatic glands) are also invariably involved.

The mesenteric glands (lying along the course of the intestines) sometimes show tuberculous changes; especially is this the case in young subjects (and in swine) in which animals abdominal tuberculosis is the form of the disease often met with. When affected, these glands are usually considerably enlarged. The lesions found on them correspond with those already described as occurring in the lymphatic glands generally.

The spleen (milt) rarely shows tuberculous changes in cattle, whilst the contrary applies to the disease in the case of horses and swine, in which animals evidence of tuberculosis is not infrequently detected in the spleen in the form of nodular growths or masses usually of somewhat firm consistence.

Tubercular lesions in the form of tubercles, nodules, abscesses, or diffuse infiltrations containing "tubercles" and granulations, may be found in any other organ of the body, the bones, kidneys, generative organs, udder, etc. Tuberculous changes are rarely observed in the skin or in the muscular tissue of the carcass (the flesh or meat), although in certain cases evidence of the disease may be occasionally detected in the intermuscular lymphatic glands, i.e. the lymph glands embedded in and lying between the muscles.

It is perhaps hardly necessary to remark that when inspecting carcasses with the object of detecting the presence of this disease, it is of the utmost importance that the lymphatic glands be submitted to most careful examination, especially is this so when it is intended to utilize the carcass for food purposes if found healthy and otherwise suitable for that purpose.

THE TUBERCULIN TEST.

As already stated, it is often a difficult matter to diagnose the presence of tuberculosis in the lower animals by physical means alone. Fortunately, however, in tuberculin we possess a diagnostic agent of great value, by means of which we are able to pick out with practically unfailing accuracy those animals which are the subjects of the disease.

Tuberculin is a fluid containing the products of growth of the tubercle bacillus *only*. It contains no living organisms of any kind whatsoever, and therefore it is quite incapable of giving rise to disease in any animal into which it may be injected.

Injected into healthy animals tuberculin produces no effect, and no harm results from its use in any animal, whether healthy or

diseased. Injected into the latter, however, it produces a marked effect, inasmuch as it gives rise to an elevation of the body temperature; this commences some nine to twelve hours after the injection, lasts a few hours, and then subsides. This temporary elevation of temperature constitutes the "reaction," and animals which manifest it are termed "reactors."

As to the realiability of the test, this has been established beyond all question. It is and has long been recognized in practically all parts of the civilized world that in the hands of a competent and experienced individual, the tuberculin test is by far the most reliable and accurate method of diagnosing the disease at our disposal. Care, experience, and intelligence are, however, needed to interpret its results correctly, and, as is the case in this country, the use of the tuberculin test should be restricted to veterinary surgeons, since they, of course, are experienced in its usage and able to draw the correct inference from the results which it furnishes.

We repeat that, properly applied, tuberculin makes exceedingly few, if any, mistakes. True, it has certain limitations, but these hardly detract from the great service which this agent has rendered, and is capable of rendering, to the veterinarian and cattle owner.

LIMITATIONS OF THE TEST.

1. Tuberculin may fail to provoke a reaction during the incubation period of the disease, *that is, in very recently infected animals*, and until the disease has had time to make some little progress. Nocard and Rossignol showed that a certain time—which is always more than a fortnight—must elapse between the moment of entry of the bacillus into an animal and that at which its effects become manifest by furnishing a reaction to tuberculin. For practical purposes this period is usually recognized as lasting from fourteen days up to about two months after the actual date of infection.

2. When the disease is extensive or generalized throughout the body of the infected animal no reaction, or only a slight one, may be obtained. Such cases, however, are not common, and, moreover, they can be detected by the veterinarian by physical means—since cases such as these generally show more or less well marked symptoms of the presence of the disease—cough, wasting, diarrhœa, etc. It is a curious fact that the reaction obtained in a tuberculous animal is usually in inverse ratio to the progress which the disease has made in that animal; thus, in one in which the disease is but little advanced a marked reaction may be obtained, whilst in another in which the disease is extensively established only a slight reaction to tuberculin may be obtained or the animal may fail to respond to the dose of tuberculin used in the test, its body being, so to speak, already saturated with the products of growth of the tubercle bacillus. Fortunately, however, such cases are rare, and, as already mentioned, the expert is usually able to detect the presence of the disease in these animals by other means.

3. The tuberculin test should not be applied to any animal in which the body temperature is already higher than normal, since in such animals it is difficult to correctly interpret the results furnished by the test.

4. For a similar reason, the test should not be applied to cows which are about to calve or which have recently calved; in such

animals the normal fluctuation of the body temperature is often marked and they are therefore not fit subjects for the test.

5. An animal which has been repeatedly submitted to the test at short intervals may subsequently fail to respond to the ordinary dose of tuberculin injected a short time afterwards. Consequently, when for any reason it is necessary to repeat the test it is desirable that an interval of four weeks or so should elapse between the two inoculations.

THE CONTROL OF TUBERCULOSIS.

Before entering into an account of the methods which are usually adopted for the suppression and control of bovine tuberculosis, it is desirable to consider briefly the manner in which animals usually become infected with this disease.

The question is often put to one: "Is tuberculosis hereditary?" In reply to this we may say that only in extremely rare instances have calves been born tubercular—so exceedingly rarely indeed has this happened that from the practical standpoint its occurrence is hardly worth considering. Practically speaking, then, tuberculosis is not hereditary.

At the present time it is well recognized that if a calf be separated from its infected parent at birth and the young animal be subsequently fed on milk which is free from the presence of tubercle bacilli, under these circumstances, and provided that the calf be otherwise protected from infection, it will remain free from the disease. *It is a well-established fact that tuberculosis is contracted after, and not before birth.*

The two chief channels by which the tubercle bacillus originally gains access to the body of an animal are

(1) by ingestion—that is, by means of food or other material containing the specific organism; or

(2) by inhalation; the organism being suspended in the atmosphere and entering the lungs and air passages with the inspired air.

It is unnecessary in this place to enter into an argument as to which of these two methods is of more common occurrence in infecting the lower animals with tuberculosis. Experiments have demonstrated beyond all question the fact that infection of animals by inhalation of tubercle bacilli may be brought about without difficulty. On the other hand there is no doubt that the entrance of the organism by ingestion is a frequent method of infection, at any rate in the lower domesticated animals.

In the young subject infection by ingestion is of common occurrence—this is true for children as well as for other young animals, which are commonly infected by milk containing tubercle bacilli. In swine, again, ingestion is the usual mode of infection; in these animals, as in children, the tubercle bacillus exercises a similar selection of tissues for the lesions.

In the case of an infected subject—a cow, for instance—sooner or later in the course of the disease a stage is reached at which tubercle bacilli are given off or expelled from the body of that animal in more or less considerable numbers, it may be by the act of coughing, or in the excrement (dung) from the bowels, in the milk, or in the discharges from the genital or urinary organs. When an animal has reached

this stage it is known as an "open" case of tuberculosis, and such animals are a grave source of danger, not only to other animals, but (and especially does this apply to milking cattle) also to mankind.

Of the various forms of tuberculosis met with, that form of the disease in which the lungs are affected is especially common. In such cases the animal is liable to expel tubercle bacilli whenever it coughs. The mucus brought up from the lungs may either be swallowed (as usually happens) and eventually pass to the exterior with the faeces (manure), or it may be bespattered on the walls, floor, food, mangers, or pasture by the infected animal when coughing. However discharged, the material is capable of infecting other animals, either directly or indirectly. Even though it has undergone desiccation before reaching another animal, such material is still dangerous, for the tubercle bacilli contained in it are not destroyed by the process of the drying.

When tubercle bacilli are discharged with the faeces (manure)—and in cases of intestinal tuberculosis the faeces contain tubercle bacilli in enormous quantities—the manure discharged in the stable or cow-shed will contaminate the latter and render the building dangerous to other animals which may be stabled in it. Obviously, if discharged at pasture, such infected manure is liable to render the ground dangerous to other animals which may subsequently graze on it. It must also be remembered that particles of dried manure containing tubercle bacilli may be distributed by currents of air and in the form of dust.

Again, manure containing tubercle bacilli is liable to infect the milk, gaining access to the latter during milking hours, either directly, the fluid faeces being switched by the cow's tail into the milk, or indirectly, by dried faeces falling into the milk vessels in the form of flakes or dust. It has been shown that much of the milk sold even for human consumption contains dirt in various forms (including particles of manure).

When the udder is tuberculous, the milk invariably contains tubercle bacilli, and under such circumstances usually in vast quantities. It is now well recognized, however, that the tuberculous cows may secrete milk containing tubercle bacilli even in the absence of apparent lesions of the udder. Especially is this true of "open" and clinical cases, i.e. those in which the disease is extensively established. Obviously, milk from such animals should not be used for food purposes, at any rate, not in the raw state. It will be necessary, however, to enter further into the discussion of this part of the subject under another heading elsewhere in the following pages.

Summarizing the usual ways in which a herd becomes infected with tuberculosis, a recent commission which studied this and other questions relating to the subject of tuberculosis came to the conclusion that the disease is spread largely

(1) through the introduction of tuberculous cattle into sound herds;
(2) by the feeding of calves with infected milk or milk products;
(3) by exposing sound animals to infected ones at fairs or other cattle shows; and
(4) by exposing them to infected cars and stables.

There are other ways in which now and then it is possible that an animal may become infected, but the means of dissemination above

mentioned are those which it is considered should be specially guarded against.

If one is to keep a healthy herd free from the disease—or in fact to prevent the introduction of diseased animals into any herd—a knowledge of these facts is essential. Especially is it necessary that all newly purchased animals be obtained only from herds which it is known are healthy and free from tuberculosis. The new purchases should be tested with tuberculin and bought only subject to passing that test satisfactorily. Moreover, on arrival at the new premises, all newly purchased animals should be isolated for a period of three months and retested at the end of that period; if now they give no reaction to the test they may be allowed to mix with the healthy animals.

Calves should not be fed with milk or milk products obtained from tuberculous cows. If any suspicion attaches to the milk it should be boiled before use.

With regard to the danger which exists of sound animals contracting tuberculosis when exposed to infected ones at fairs or other cattle shows, most danger is to be apprehended from the presence of "open" cases of tuberculosis. In so far as concerns animals shown at the principal shows in South Africa, it may be said that these are submitted to veterinary inspection, and, needless to say, any which show evident symptoms of this or other disease are rigidly excluded and prevented from contact with other animals.

It is perhaps hardly necessary to point out the extreme importance which attaches to the thorough cleansing and disinfection of cowsheds or other buildings in which "open" cases of tuberculosis have been stabled. The same applies, of course, to railway trucks and cars which have been used for carrying infected animals. The laws relating to stock diseases in South Africa provide for the cleansing and disinfection of all such vehicles which have been used for the purpose of transporting stock.

The next point to consider is how is one to deal with tuberculosis when its presence in a herd is known or suspected?

Many methods have been advocated, amongst the principal being the three following:—

1. The "stamping out" method. In this method all "open" or clinical cases are slaughtered, as well as those which react to the tuberculin test. This is followed, of course, by disinfection of the premises formerly occupied by the slaughtered animals.

With regard to the method of dealing with the disease in South Africa, in this country tuberculosis is a scheduled contagious disease, and is dealt with on the lines above indicated, compensation being granted for animals destroyed under the Act. Moreover, all such animals are carefully inspected after slaughter by a Government veterinary officer, and the owner is allowed to retain and to make use of any portion of the carcass which is passed as being unaffected with disease and fit for food purposes, all diseased portions being, needless to say, destroyed. It is considered that tuberculosis has not yet gained a firm footing amongst animals in South Africa, and this method is therefore applied with the object of controlling the disease and eliminating it as far as possible. At the same time most stringent measures are enforced to prevent the reintroduction of the disease into the country with stock imported from overseas.

2. The method known as the "Bang" system (after Professor Bang, a Danish veterinary authority who originated it). In this method all "open" or clinical cases are destroyed and the remainder of the herd is then tested with tuberculin. Following the test the herd is divided into two portions—(a) those which have reacted to the tuberculin test, and (b) those which have not reacted. The reacting and non-reacting herds are kept entirely separate and apart from each other, both when stabled and when at pasture. Each herd has separate attendants and separate stable utensils. Calves born to the reactors are removed from their mothers at birth and placed in the stable of healthy (non-reacting) animals, where they are reared on milk provided by a healthy cow or on milk which has been boiled or pasteurized.

The healthy herd is tested with tuberculin every six months, and if any further reactors are found these are at once removed to the diseased herd, and the stall or stable they have occupied is disinfected. Any "open" or clinical case occurring in the diseased herd is at once removed and slaughtered.

The milk from the reacting animals is allowed to be used after it has been efficiently sterilized by boiling or pasteurized, i.e. heated to a temperature lower than the boiling point, but sufficient to destroy any tubercle bacilli which may be present.

In this way a sound herd is gradually built up, whilst the diseased herd becomes smaller and smaller as the animals contained in it die naturally or are slaughtered. When only a few animals are left in the diseased herd these are slaughtered off, and the owner is finally left with a sound, tubercle-free herd. This desirable object, may, however, take years to accomplish by this method, and for its successful carrying out it is essential that the owner and his assistants be well informed, painstaking, and really anxious to rid the herd of the disease, otherwise a large official staff is necessary to supervise the efficient carrying out of the necessary measures, and even then, without the whole-hearted co-operation of the owner and the cattle attendants the method is liable to fail.

3. A modification of the "Bang" method, known as the Ostertag system (after Ostertag, a German veterinary surgeon, who devised it).

In this system the herd is treated as entirely diseased, and the new-born calves alone are used to build up a new and healthy herd. All "open," clinical, and obviously dangerous cases are slaughtered. The calves, as soon as they are born, are removed to a separate building and kept apart from the other cattle on the farm. The calves receive only milk obtained from cows which are known to be free from tuberculosis.

The young animals are tested with tuberculin at six months old, and thereafter at stated intervals. Reactors, if any are found, are at once transferred to the diseased herd.

In this system, as in the "Bang" method, use is allowed to be made of the reacting animals, in fact of all animals which are not "open" and obviously dangerous cases. As already mentioned, the milk may be used after boiling or pasteurization, and the animals can be used for breeding purposes or they may be fattened and finally slaughtered under supervision.

The Bang system is especially applicable to those herds in which

but a small number of infected animals exist, whilst if many tuberculous animals are present in a herd (say 50 per cent or more) the Ostertag method is more likely to be of practical service.

For the success of the Ostertag method, as for that of Bang, the whole-hearted co-operation of the owner is essential; moreover, if an owner be allowed to keep a number of known diseased animals in his herd, it is necessary from the public health standpoint (1) that he be prohibited from selling the diseased animals except for slaughter under efficient supervision, and (2) that he be prohibited from selling or utilizing for human consumption the milk from any animal in his herd as long as diseased ones remain therein. The only alternative is that the milk be boiled or efficiently pasteurized before being so sold or utilized, and, needless to say, for the supervision of such measures a large official staff would be required.

(To be continued.)

Winter Pasture-Grasses.

By JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

THE best winter pasture plants yet introduced into South Africa, and which have been thoroughly tested, undoubtedly are

New Zealand tall fescue (*Festuca arundinacea*);
Paspalum dilatatum;
Paspalum virgatum;
Cocksfoot (*Dactylis glomerata*);
Chewing's fescue (*Festuca ovina* var.);
Phalaris bulbosa;
Italian ryegrass (*Lolium italicum*).

The relative importance of these grasses will depend on the part of the country in which they are intended to be grown, but other things being equal the above sequence indicates broadly their relative importance.

Each of these grasses has a special purpose to fulfil and these may be briefly described as follows:—

New Zealand tall fescue (*Festuca arundinacea*) is the most hardy of all, being resistant to both frost and drought; it has withstood 14 degrees of frost at Skinners Court and 24 degrees at Ermelo. It prefers a heavy, clayey soil and is not well suited to light, sandy soils. It prefers good land and a copious rainfall, and does remarkably well under irrigation. But it also succeeds in the poorer and drier soils. It volunteers freely from seed, is a vigorous grower, and furnishes a large amount of feed. I have known it to make a growth of 6 inches in the month of July, without water, and after it had been close grazed by sheep. 40 lb. of seed should be sown per English acre.

Paspalum dilatatum spreads more quickly from volunteer seeds than tall fescue, but is sensitive to frost, and is therefore of less value on the colder parts of the high veld. But it is an excellent grass for sheltered places, and for sowing among rocks on kopjes, or on river banks in bushveld country. Some farmers complain that their cattle do not eat this grass readily, but they are in the minority; if paspalum is allowed to get coarse, stock do not care for it so much, but if kept closely grazed it is a beautifully sweet grass. Paspalum grows well in almost any kind of soil, but my experience with it is that it does not like pot-clay. Sow about 10 lb. of seed per acre.

Paspalum virgatum, the upright paspalum, is a taller, coarser grass than *P. dilatatum*, but is less sensitive to frost though not as hardy as tall fescue. It is very coarse unless kept closely grazed, but makes a useful, though coarse, hay. It does well on heavy soils. Sow about 5 lb. of seed per acre.

Cocksfoot (*Dactylis glomerata*) is an excellent pasture grass where the conditions favour it, but it is one of the most difficult to establish in South Africa. In a few localities along the Drakensberg, and

especially near Kokstad, it appears to do well, but in many localities it seems to die out early and to suffer from rust or drought. Cocksfoot is eminently a grass for cool, damp localities. It will probably be found most satisfactory to sow it in mixtures with tall fescue and other grasses.

Chewing's fescue (*Festuca ovina* var.) is a fine-leaved sheep grass, best suited to sandy soils in regions of good rainfall and not too great heat. 15 lb. of seed per acre is the usual sowing.

Phalaris bulbosa is a much advertised grass and one which stands frost admirably; but my experience is that it requires *rich* soil, plenty of water, and frequent cultivation and manuring. Given these conditions this grass will furnish an enormous amount of succulent, nutritious green feed in the winter months. It seems best suited to rich sandy-loam soils; in heavy soils at Skinners Court and Groenkloof I have not, so far, had good results from it. 3 lb. of seed per acre is recommended. This grass should be particularly useful for dairy farmers, especially if planted in a small camp near the sheds, where it can be kept under water and given manure freely. It will take the place of green barley and will not require to be resown from year to year.

Italian ryegrass (*Lolium italicum*) is a most excellent winter grass for water-laid lands and for the mist-belt of the Drakensberg. It is a very quick grower, and hardy against frost, and gives a heavy yield. It is a wonderful milk-producer and should be grown by all dairy farmers who have favourable conditions. It has been reported that if sown as late as the middle of February it will make a good pasture for the first winter. It is not perennial, but must be resown every second or third year. About 30 lb. of seed per acre.

TIME FOR SOWING.

The principal causes of failure with grasses in South Africa is traceable to sowing at the wrong season. Pasture grasses are not like mielies; they will not stand much hot, dry weather while young. It is essential to success, therefore, that one choose for sowing the time of year when cloudy weather and steady rains can be relied upon. There are two such seasons in South Africa, the autumn and the early spring. In parts of Natal and the Eastern Province the middle of October to middle of November has been found a satisfactory time; in the western Transvaal, January seems to be the only reliable month, and in the central and eastern Transvaal February is usually the safest month.

Chlorosis in Orchards near Bloemfontein.

By Charles F. Juritz, M.A., D.Sc., F.I.C.

(Continued from page 865.)

Physical Composition of the Soil.

Even if the effects noticed in the Bloemfontein orchards had originated from brack, at the worst the alkali salts could be washed out of the soil, provided the sub-soil were not so impermeable as to form a sort of basin through whose bottom these salts cannot be passed, and within which they are apt to collect and cause injury. The question therefore arises: Is the soil below permeable or not? This leads up to the discussion of the mechanical analyses of the soils collected. Such mechanical analyses were made in respect of the samples whose percentage results (obtained according to the method described on pp. 193 to 195 of my "Agricultural Soils of Cape Colony") are tabulated below:—

No.	Pebbles. > 3 mm	Coarse gravel 3–2 mm.	Fine gravel 2–1 mm.	Coarse sand 1–.5 mm.	Medium sand ·5–·25mm.	Fine sand ·25–·1mm	Very fine sand ·1–·05mm.	Silt ·05–·01 mm	Fine silt ·01–·005 mm.	Clay <·005 mm.
1	2·64	·64	1·00	1·03	11·35	34·02	11·70	9·04	15·09	13·48
1c	3·59	1·63	2·67	1·98	7·29	28·10	11·41	11·61	17·73	13·99
2	1·74	·54	1·03	1·25	12·50	30·47	9·82	9·68	16·91	16·07
3	·60	·25	·74	·65	5·37	35·54	13·10	14·62	17·59	11·54
3b	·02	·11	·45	·60	4·32	27·14	13·44	16·31	22·24	15·37
4	·28	·17	·68	·98	6·44	55·08	11·60	4·06	9·49	11·22
4a	·08	·16	·63	·77	5·96	43·92	8·18	6·38	17·40	16·52
4b	·24	·32	·70	·85	6·12	40·57	9·00	7·12	18·29	16·77
5	·12	·07	·34	·78	6·73	56·73	10·10	4·75	9·89	10·49
6	·16	·76	·84	·92	4·69	51·12	16·57	6·43	10·37	8·14
6a	·73	·40	·75	·83	4·94	49·50	14·32	6·02	10·80	11·71

Except for the slight inclination towards pebbliness exhibited by Mr. Diesel's soils, all these samples were uniformly fine in grain; they may all be classed as fine, sandy loams, with the exception of No. 3b, which has less sand, and is more properly called a loam.* The proportions of sand, silt, and clay may be more easily compared if summarized thus:—

No.	Sand.	Silt.	Clay.
1	58.10	24.13	13.48
1c	48.78	29.34	13.99
2	54.04	26.59	16.07

* Hilgard (see "Soils," p. 84) would probably call Nos. 2, 3b, 4a, and 4b clay loams, No. 6 an ordinary sandy loam, and the others sandy loams.

No.	Sand.	Silt.	Clay.
3	54.66	32.21	11.54
3B	45.50	38.55	15.37
4	74.10	13.55	11.22
4A	58.83	23.78	16.52
4B	56.54	25.41	16,77
5	74.34	14.64	10.49
6	73.30	16.80	8.14
6A	69.59	16.82	11.71

The virgin soil, No. 5, taken outside Mr. Kolbe's orchard, is identical in mechanical composition with the orchard soil No. 4, a fact which would suffice to show that cultivation had not brought about much alteration in this respect. From these two samples No. 6 does not differ materially; it has slightly less clay and a little more silt in its composition. These three soils, however, exhibit a distinct variation from the other three surface soils, Nos. 1, 2, and 3, and it is worth noting that, generally speaking, the condition of the orchard trees on the former soils (Nos. 4, 5, and 6) was better than on the latter, at least so far as chlorosis was concerned. The averages of the two types of soil are as follows, leaving out of consideration the coarser soil grades: and it will be observed that in neither type do the individual soils vary much from their respective averages:—

No.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Fine Silt.	Clay.
1, 2, 3	.98	9.74	33.34	11.54	11.11	16.53	13.70
4, 5, 6	.89	5.62	54.31	12.76	5.08	9.92	9.95

or, summarizing these figures as in the previous table:—

	Sand.	Silt.	Clay.
Nos. 1, 2, and 3	55.60	27.64	13.70
Nos. 4, 5, and 6	73.58	15.00	9.95

In the individual soils the percentages of silt and clay, taken together, are as follows:—

No. 1	37.61
No. 2	42.66
No. 3	43.75
No. 4	24.77
No. 5	25.13
No. 6	24.94

Note here again the clear difference between the two types; the soils about Floradale are much more compact and inclined to be clayey than those at Kaalspruit, and, therefore, quite naturally, less permeable to water. Especially is this so in their lower levels, so that, if drenched with water, they will free themselves from surface moisture much less readily than the Kaalspruit type of soil.

So one may almost venture to say that it was on soils containing in their surface foot about 40 per cent. of silt and clay that chlorosis was the more pronounced; it was less noticeable where silt and clay together averaged about 25 per cent., and where over 70 per cent. of the soil consisted of sand. But these remarks must not be understood as attributing the chlorotic condition of the trees to the mechanical condition of the Floradale soils. Without any *other* contributing factor the *mere* mechanical composition of these soils would not suffice

to produce the effects observed in some of the orchard trees.* To make my meaning on this point more clear, I may compare the composition of the above soils with that of some soils of similar type examined, in connection with the soil survey of the United States by the Department of Agriculture of that country. Below will be found tabulated the mechanical composition of seven typical fine sandy loams occurring in the United States. They represent the following types of soil:—

A. Portsmouth fine sandy loam.
B. Chester fine sandy loam.
C. Clarksville fine sandy loam.
D. Miami fine sandy loam.
E. Marshall fine sandy loam.
F. San Joaquin fine sandy loam.
G. Puget fine sandy loam.

The mechanical percentage composition of these seven types of soil averages as follows:—

	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
A	0	2	4	53	12	17	12
B	1	9	7	24	17	27	15
C	1	3	10	43	11	25	8
D	2	6	10	27	14	28	13
E	1	6	10	34	15	22	11
F	1	5	4	26	18	28	17
G	0	3	2	20	16	37	21

Below I have arranged the two varieties of Bloemfontein soils in a similar manner for easy comparison:—

	Fine gravel	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
1, 2, 3	1	1	9	33	12	28	14
4, 5, 6	1	1	6	54	13	15	10

NEED OF DRAINAGE.

Of the two types of fine, sandy loam occurring in the Bloemfontein orchards, it will be seen that the first—what I have already called the Floradale type—approaches more nearly to E of the American soil types than to any other of them, whilst the remaining Bloemfontein soils—the Kaalspruit type—more resemble A. The Marshall soil, however, differs from that at Floradale in the sub-soil and lower levels, not by an increasing amount of sticky clay (because that is typical of *both* places), but by being underlain by a boulder clay at a depth of three or four feet, and by possessing an undulating or rolling surface, which generally affords sufficient drainage so that the soil has a wide crop adaptation and is very productive. The Portsmouth soil, on the other hand, has a decidedly more clayey sub-soil than that at Kaalspruit, but *it is characterized by lack of drainage*, and supports a heavy growth of water-loving trees. *When properly drained* vegetables are readily cultivated. The point is that, of the two classes of

* None of the soils can really be called very heavy clays, and the presence of a moderate proportion of clay is distinctly advantageous, not only to the physical properties of a soil, but also to its chemical qualities, for, as has been truly said, *poor* clay soils are quite exceptional.

soil, that which seems to do better in America is the worse of the two at Bloemfontein. This goes to show that the fault does not lie in the mere mechanical condition of the soil.

At the same time, many soils of this class are apt to show defects of a certain kind. The Chester soil occupies rolling country, and so has generally good surface and under drainage. In the Clarksville soil, though surface drainage is complete, the sub-soil, which contains about 30 per cent. of clay, retains a large quantity of moisture. This soil is reported excellent for peaches, and, *where well drained*, for cotton and other general farm crops. The sub-soil of the Miami ty is also much more clayey than any of the Bloemfontein samples, the clay reaching 26 per cent., but *it has good drainage*, is used for general agriculture, and is said to be specially adapted for fruit culture. The San Joaquin soil is compact in structure and sticky when wet, *drainage being usually somewhat restricted*. In favourable localities, where the underlying hardpan does not approach the surface too closely, it grows vines, as well as bramble and other small fruits. In the Puget soil, notwithstanding its high percentage of clay near the surface, the sub-soil contains only 6 per cent. But, in spite of the apparently favourable nature of the sub-soil from a mechanical point of view—this sub-soil contains as much as 35 per cent. of coarse and medium sand—*its drainage is poor, and cultivation is impracticable unless artificial drainage is established*. This is obviously due to the low and flat topography and the fact that the type of soil is found in depressed areas along streams.

UNSATISFACTORY MOISTURE CONDITIONS.

Consideration of all the above points strengthen the conclusion that it was not their mechanical composition *in itself* that caused the Bloemfontein soils to affect the orchard trees injuriously, but that the fine-grained texture of the soil tended to intensify the pre-existing unsatisfactory moisture conditions.

A most important phase of this inquiry is accordingly concerned with the moisture relations of the soils in question. Incidentally I have already hinted at these. Some aspects hereof are grouped in the table below, which shows (1) the apparent specific gravity of the soils* precisely as they lay in the orchards, except that the pebbles were sifted out, and the soils allowed to become air-dry before making the determinations. This apparent specific gravity covers the whole volume occupied by the soil, including the pores or air spaces between the soil grains, (2) the true specific gravity of the soil, i.e. taking account only of the actual soil particles without the intervening air spaces, (3) the volume percentage of air spaces in the air-dry soil, in other words, the soil's degree of porosity, (4) the percentage of moisture that 100 parts of each soil can absorb by capillarity,† (5) the total percentage of moisture that would be added to the same quantity of soil if, in addition to the moisture absorbed by capillarity, all the air spaces in the soil were filled with water, i.e. if the soil were completely water-logged, (6) the percentage by weight of capillary

* "Ordinary soils in good tilth have an apparent specific gravity of about 1·2, and, when entirely free from air, a real specific gravity of about 2·5" (Wiley: "Principles and practice of agricultural analysis," vol. 1. p. 96).

† Determined according to the Wolff-Wahnschaffe method; see Wiley's "Agricultural analysis," vol. 1, p. 148.

moisture actually taken up by the (original air-dry) soils *in situ* in the orchards,* (7) the proportions of hygroscopic moisture, (8) of capillary moisture,† and (9) of total moisture found to be contained in 100 parts by weight of the more or less moist soil *in situ* :—

No.	Apparent specific gravity.	True specific gravity.	Porosity vol. per cent.	Percentage capacity of air-dry soil for moisture.		Percentage of capillary moisture taken up.	Percentage of water in soil.		
				Capillary.	Total.		Hydroscopic.	Capillary.	Total.
1	1·24	2·48	50·0	35·6	40·3	18·7	3·25	15·78	19·03
1a	—	—	—	—		—	—	—	18·86
1b	—	—	—	—	—	—	—	—	13·09‡
1c	1·29	2·50	48·4	32·0	37·5	—	—	—	—
2	1·17	2·46	52·4	38·6	44·8	11·9	5·25	10·61	15·86
3	1·25	2·47	49·4	33·8	39·5		—	—	—
3a	—	—	—	—	.		—	—	21·07
3b	1·14	2·44	53·3	39·3	46·8	20·3	5·47	16·85	22·32
4	1·29	2·55	49·4	32·7	38·3	11·6	1·68	10·43	12·11
4a	—	-	—	—	—	12·8	4·23	11·32	15·55
4b	-	-	.	—	—	11·5	3·76	10·29	14·05
5	1·31	2·57	49·0	31·2	37·4	3·2	2·01	3·08	5·09
6	1·34	2·58	48·1	30·5	35·9	9·0	1·19	8·30	9·79
6a	—	—	—	—	—	6·0	1·88	5·69	7·57

In the above table we see again that the differences do not lie in the natural physical condition of the soils. They are more or less similar in density, except that Nos. 5 and 6 are rather looser than the other surface soils. Their porosity§ is also more or less of the same order all through the series, and their relative capacities for absorbing water do not call for any special comment. It is when we come to compare that water-holding *capacity* with the amounts of water that the orchard soils *had actually taken up* that we find the differences. In the soil where the yellowing was worst (No. 1), out of 40.3 per cent. of water capable of being held by the soil, 18.7 per cent. had been actually taken up, which means that nearly 50 per cent. of the soil's available air space was filled with water, and this was the condition five months after the soil had been irrigated. What the aeration conditions of the soil must have been *during the time of irrigation* may be left to be imagined. At this point in the lower soil levels there was even less aeration and a stiffer and moister condition of soil. At No. 2, where recovery had taken place, only approximately one-fourth of the air space was occupied by water, 11.9 per cent. out of a possible

* Hellriegel's experiments led him to the conclusion that, in order to supply the plants growing on it with all the moisture they need, and as fast as they need it, this percentage should not fall below one-third of the soil's total percentage capacity for moisture.

† The meaning of "hygroscopic" and of "capillary" moisture in this connection is explained in my "Notes on soil moisture" in the *Union Agricultural Journal*, vol. 2, 1911, pp. 741 and 745.

‡ Owing to the Department of Agriculture possessing no laboratory in the Orange Free State, the samples had to be conveyed to Capetown, a distance of 750 miles. On the journey the rubber cap of the tube containing sample No. 1b was damaged, and hence the possibility that the percentage of water indicated above may be lower than the amount actually present in the soil as it was taken *in situ*.

§ The porosity of most cultivated soils ranges from 35 % to 50 %. In sandy soils it may fall as low as 20%, and in alluvial clays it may approach 70 %. See Hilgard: "Soils," p. 109.

44.9 per cent. of water having been taken up. At No. 3 the conditions were somewhat similar to those obtaining at No. 1, though less emphasized, and it will be remembered from the descriptive part of this paper that the trees here were also in a less sickly state than at No. 1. Then we come to Nos. 4, 5, and 6. At the first of these spots the moisture conditions of the soil were far better than at Nos. 1 and 3, being, in fact, more or less similar to No. 2, while at Nos. 5 and 6 the soils had not taken up more than one-twelfth and one-fourth respectively of the amounts of water that they were capable of holding, No. 5 being a virgin soil and No. 6 a well-loosened orchard soil.

I should like the figures in the last three columns of the above table to be compared with the following experimental results obtained by Loughridge.*

Crop.	Soil.	Condition of Crop.	Percentage of water in soil.		
			Hygroscopic.	Capillary.	Total.
Almonds ...	Loam	Good	6·6	1·9	8·5
Apples	"	Excellent	5·5	2·8	8·3
Apricots ...	"	"	3·3	3·0	6·3
Figs	Red loam	Good	3·8	1·4	5·2
Peaches ...	"	"	5·0	3·2	8·2
Prunes	Grey loam	Excellent	9·0	2·2	11·2
Citrus fruits ...	Sandy loam	Good	3·1	3·2	6·3

Perhaps the figures in the last table but one may be better understood if put in another form. The following, therefore, expresses in a different manner the results given in the first, fourth, fifth, and sixth columns of percentages of that table, adding another column to show the ratio of the amount of air space which was occupied by water in the soils and the total amount of air space available, taking that total amount as 100:—

No.	Weight of 1 cubic foot of air-dry soil.†	Weight of *capillary* water capable of being absorbed by 1 cubic foot of such soil.	Total capacity of 1 cubic foot of soil for capillary and *free* water.	Weight of capillary water present in 1 cubic foot of soil.	Percentage of soil's original air space filled with water.
	lb.	lb.	lb.	lb.	
1	77·27	27·50	31·16	14·45	46·4
1c	80·39	25·73	30·16	—	—
2	72·91	28·13	32·66	8·67	26·5
3	77·90	26·33	30·79	—	—
3b	71·04	27·91	33·22	14·42	43·4
4	80·39	26·29	30·79	9·32	30·3
5	81·64	25·47	30·54	2·61	8·5
6	83·51	25·47	29·98	7·52	25·1

* Report, California Experiment Station, 1907–1908.

† "It may be conveniently remembered that, while average arable loams range from about 80 to 95 lb. per cubic foot, 'heavy' clay soils range from 75 lb. down to 69." (Hilgard: "Soils," p. 107.) This refers, however, to completely dried soil, not to merely air-dry soils.

From this table it is observable that in the two worst soils 43 to 46 per cent. of the air pores were filled with water; in the case where there had been recovery from chlorosis only 26.5 per cent. of these air spaces were occupied by water. On the virgin soil the percentage of the total air space that was water-filled was only 8.5, and the other two soils, where the trees were in better condition, also enjoyed more satisfactory aeration.*

Prof. Whitney, of the United States Department of Agriculture, says:—

It is necessary to have a supply of oxygen around the roots. Physiologists differ as to the office the roots have in regard to the absorption of oxygen, . . . but it is unquestionably a fact that roots of cultivated plants require oxygen around them for their healthy growth.†

But unsatisfactory moisture conditions in a soil bring in their train other ills besides those just glanced at. These may be hinted at in a few words. It is stated‡ that the optimum proportion of capillary water in soils is not less than 40 per cent. nor more than 60 per cent. of the soil's total water-holding capacity, but this optimum varies for different plants. It will be noticed, however, that in the Bloemfontein soils the only instances where the above minimum of 40 per cent. was exceeded were those where chlorosis was most strongly marked, and so the probability is that during a great part of the year the optimum condition must have been far exceeded. Now the slope of these lands is but slight, and, with defective drainage, the swamping of the sub-soil is bound to cause a sickening of orchard trees, for their deeper roots, frequently reaching 15 to 20 feet below the surface, become submerged in the rising water, and the injury becomes all the greater when that rising water brings up with it alkali or brack salts, while the stagnation of the water in the soil causes bacterial fermentation of the organic matter there, transforming the ferric hydrate into ferrous carbonate, a compound poisonous to the roots. Hilgard relates how by this swamping process the orchards of the Sierra Foothills of California, planted in ferruginous land, succumbed to the poisonous effects of ferrous carbonate.§

In order to illustrate the capillary movement of water in soils the results of the following table are tabulated; these determinations were made for the purpose of testing the rate of rise by capillary attraction of water in the various soils under examination,‖ and the table shows the heights in centimetres to which water rose in each of the soil samples during various times, ranging from 100 minutes to 262 hours:—

No.	1	1c	2	3	3b	4	4a	4b	5	6	6a
100 mins.	17	12	21	16	13½	16½	13	11½	22½	30	29½
18 hours	36½	27	32	40	25	31½	29½	33	41½	59½	56½

* If the pores or air spaces in a soil are practically half filled with water five months after irrigation, it is not difficult to imagine a complete filling during the irrigation season, said to last *six months*. It is worth noting here that Hilgard asserts that deciduous orchards may bear *three weeks* of such total exclusion from the free access of atmospheric oxygen, but when in the growing condition injury is suffered much more quickly. ("Soils," p. 201.)

† United States Department of Agriculture Farmers' Bulletin No. 257, p. 6.

‡ *Vide* Hilgard: "Soils," p. 202.

§ "Soils," p. 288.

‖ Wahnschaffe: "Scientific examination of soils," p. 158.

No.	1	1c	2	3	3b	4	4a	4b	5	6	6a
24 hours	39½	30	33½	43½	28	34½	32	36½	44	61½	60
48 ,,	47	42	37	50	37½	42	39	43	49½	67½	68½
72 ,,	50½	51	—	54½	44	46	43	46	53	70½	73½
96 ,,	53	57½	40½	57½	47	49	46	—	55½	72½	77
120 ,,	54½	61	42	60	49½	51½	48½	—	57½	74	79½
144 ,,	56	63½	43½	63	51½	53½	50½	52½	59½	75½	81
168 ,,	57	66½	—	65½	53	55	51	54	60½	76½	82½
192 ,,	58	68½	—	67½	55	56½	53	56	61½	77½	83½
216 ,,	59	70	—	69½	56	57½	54	57	62½	78½	84½
262 ,,	60½	73	—	72½	58½	59½	55½	60	64	80	86½

Broadly speaking, the soils containing least clay showed the highest rise of water within the time devoted to this series of experiments; thus, of the surface soils, No. 6 contained about 8 per cent. of clay, and No. 2 approximately double that amount; in six days water rose in No. 6 to a height of about 75 centimetres, but in No. 2 to not much above half that height.

PREVIOUS INVESTIGATIONS OF CHLOROSIS.

The yellowing of leaves of fruit trees and of other trees and plants on account of cultural faults similar to those above indicated is not uncommon. About seventeen years ago a considerable amount of apprehension existed amongst fruit-growers in the Cape Colony on account of what were supposed to be occurrences of the disease known as "peach yellows," and existing in the Eastern States of the American Union. In some of these cases, occurring in the Queenstown Division, the late Professor MacOwan, then Government Botanist, did, it is true, find spores of *Uredo castagnei* Rav., but, as Dr. MacOwan remarked at the time, "this is not peach yellows by a long way." He went on to point out that peach trees planted in holes in unloosened impervious soil, into which holes we persist against common sense in running irrigation water until it stands in a pool round the collar, must inevitably be killed by water-logging.*

Early in 1894, Mr. P. R. Malleson, of the Cape Orchard Company, and Mr. E. Pillans, Government Horticulturist, made a tour of inspection in connection with further reported cases of this character in the Division of Cradock. Precisely as in the Bloemfontein orchards, they found in the old trees a general yellowing of the leaves, but a branch here and there, exactly as on Mr. Fischer's farm near Bloemfontein, bore normal foliage. In their report† Messrs. Malleson and Pillans remarked:—

> The whole aspect was precisely such as an experienced gardener would pronounce to be caused by *mischief at the roots*. Turning to the soil, we found it, in every instance where the so-called "yellows" existed, to consist of a more or less dense clay, precisely the kind of material which, in the absence of repeated trenching to a greater or less depth, is certain to form itself into a coherent mass, destitute of the necessary aeration, and excessively retentive of water. . . . It is scarcely possible to conceive of conditions more unfavourable for the

* "Try an experiment," said he, "cork up the hole at the bottom of a pot-grown fuchsia, fill the pot with water till it stands full to the brim for a couple of days or so. That fuchsia will get fuschia-yellows right away, and drop every leaf to the last one. Then, if you take the cork out, and stop the nonsense with the water-can, it may recover, and start a fresh lot of leaves, after having given you a lesson for the orchard." (*Cape Agricultural Journal*, 14th June, 1894, p. 273.)

† *Cape Agricultural Journal*, 7th March, 1895, p. 116.

health of tree roots, deprived of the air necessary to their continuous respiration, and water-logged every time their turn for irrigation comes round. The white absorbent portions of the rootlets perish utterly and rot away. As soon as this commences, the supply of water carried up to the foliage and growing twigs decreases as the mischief increases—the leaves first and then the twigs can no longer continue their functions; the green chlorophyll-contents of the cell die, and are bleached out to a sickly yellow by the hot sunshine. . . . The leaf-yellowing which we have been investigating, and which some growers have been anxious to call peach yellows, certainly affects the peach and its allies, but we found it doing precisely the same to the apple, pear, quince, and orange, wherever the same unfavourable cultural conditions existed. . . . The cultural nature of the mischief appears to prove the remarkable fact that, even where the soil is strongly clayey, leaf-yellowing does not make its appearance in *recently* planted orchards which have been trenched up as a preliminary proceeding. That operation has opened and aerated the soil, rendering it wholesome for root growth. . . . No one instance of the disease has been signalized in localities where the soil is so sandy and porous as to allow of a natural drainage by percolation equally rapid with the usual irrigation supply.

The description above quoted with regard to the Cradock orchards might have been equally appropriately written of those around Bloemfontein. Where the yellowing was worst—on the farms of Messrs. Diesel and Fischer—there the soil was stiffest. On Mr. Kolbe's farm there was less yellowing, and there was also a looser soil. In the orchard of President Steyn the soil was loose and sandy, the surface was well broken up, and yellowing was entirely absent, the trouble being of quite another kind.

It is in any case impossible to relieve a soil of its superfluous water without some system of under-drainage. To grow a kitchen garden amongst the fruit trees in an orchard, supply it with water continuously, and allow that water virtually to stagnate in the basin formed by an impervious clayey layer or calcareous hardpan three or four feet deep, means death to the fruit trees.*

We do not yet know all that we need in regard to the best proportions of water for fruit cultivation in this country, but in the December issue of the *Union Agricultural Journal* I have alluded to the desirability of arriving at more definite data concerning the optimum supply of water for various soils and crops. I suggest that the proportion of moisture present in some of the Bloemfontein soils *in situ* during the time when water is frequently led on to them is excessive in amount; but until such an examination as the above is carried out during the irrigating season the clinching of positive certainty may lack completeness, while more dogmatic pronouncements than we can give at present await a fuller knowledge of the optima moisture conditions for soils in various parts of this Union.

SUMMARY.

1. For some years past chlorosis, or yellowing of the leaves, accompanied by a general lowering of vitality, has been noticeable in orchards around Bloemfontein.

2. The soils of these orchards may be divided into two types: the Floradale type, with grey-brown soils, and the sandier Kaalspruit type, comprising red-brown soils.

3. All these soils are on the whole well supplied with plant food, more particularly those soils where the chlorosis was worst.

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* Moreover, rich in food plant though the Bloemfontein soils may be, a remark made in the course of Messrs. Malleson and Pillans' report will sooner or later come to be applicable even there: "We have found it almost impossible to make growers see that leaving their area over to the increase of weedy grasses in the interest of a few milch stock, or setting it out in little beds to grow snatch crops of vegetables, amounts in both cases to robbing the trees of their due."

4. The proportion of magnesia relatively to lime was highest in the soils where the orchards were most affected, but in all the surface soils, even in those where chlorosis was absent, this proportion exceeded the ratio .5 : 1. A high proportion such as this is stated to have caused chlorosis in pineapples at Porto Rico.

5. The affected area is underlain by a more or less marly substratum, and this marliness of the sub-soil was greatest (9.50 per cent. of carbonate) where the chlorosis was worst, less where the yellowing was not so prominent, and practically non-existent (.18 per cent. of carbonate) where chlorosis was absent. Marliness is known to cause chlorosis in other parts of the world, and can to a certain extent be corrected by green or stable manure.

6. This calcareous substratum, moreover, converts the sub-soil into a kind of basin, wherein water collects and drowns the roots of the trees.

7. Water soluble salts, which comprise those generally called "brack" or "alkali," were largest in amount in the soils of the Floradale type. They consisted, however, in every case, for the most part of carbonates of lime and magnesia, true alkali salts being present in relatively small proportion, and the largest proportions of the latter being found in the sub-soils of the farms where the marly substratum was less in evidence. Hence there seemed no reason to connect the occurrence of chlorosis with excessive brack.

8. Physically, the soils of the entire area may be classed as fine, sandy loams, those of the Floradale type being the stiffer, and containing about 40 per cent. of silt and clay in the 12 inches nearest the surface, while the soils of the Kaalspruit type contain about 24 per cent. of silt and clay in the surface foot.

9. Soils thus physically constituted have proved satisfactory under proper cultural conditions, i.e. where drainage is good and the soil moisture conditions sound, but they are apt to become compact and intractable where drainage fails, if they receive a large supply of moisture.

10. Soils of the nature of the Floradale type are liable to fail under excessive irrigation sooner than those of the Kaalspruit type. The capacity of the average soil of both types for holding water up to the point of complete saturation is about 29 to 32 pounds of water per cubic foot of soil. In the soils where chlorosis was worst between 40 and 50 per cent. of the soils' total air space was filled with water, and this, in one instance, five months after irrigation. Where chlorosis was less in evidence, or absent, the space so filled amounted to only from 25 to 30 per cent. of the total capacity, and on the adjacent virgin soil it was only 8 per cent.

11. The direct cause of chlorosis is the inability of the plant to take up an adequate amount of iron, which is in some obscure way used in connection with the production of the chlorophyll, or green colouring matter of the leaves, although it does not itself constitute a part of that colouring matter. This inability to take up iron is the result of impaired vitality, which may be brought about by fungoid disease of the roots, or by bad soil conditions. The bad soil conditions may comprise, amongst others, too large a proportion of magnesia relatively to lime, excessive marliness, or defective aeration of the soil. The defective aeration may in turn be brought about by the soil being too stiff and clayey, or by its being water-logged, that is to say, over-

irrigated, or supplied with more water than drainage can carry off. In the present case, though some of the former causes are apparently contributory, they seem to be largely aided and intensified by the unsatisfactory moisture conditions to which reference has been made, coupled with the existence of a fairly impermeable substratum of marl.

Agricultural Education in the United States of America.

By G. J. Bosman, B.S.A.

Perhaps no other country in the world is doing more for agricultural education to-day than the United States of America. In each of the forty-eight States and Territories constituting the Union is an agricultural college with an average attendance of about 400 students. In connection with each of these State colleges is established at least one experimental station equipped with an efficient staff of agricultural experts. Furthermore, in a great many States they have gone so far as to have a special agricultural teacher in each high school and normal college. Teachers in the rural public schools are required to have a knowledge of the elements of agriculture so that they can devote a few hours each week to the teaching of that. The American people realize the necessity of teaching the farmer his profession. Through the colleges, high schools, and experiment stations only a small percentage of the people is reached, so another institution or force was created with the special purpose of taking scientific knowledge of agriculture to the homes of the farmers. This force was called the Extension Department. The Extension Department teaches the farmer agriculture; his wife, household science; and the boys and girls are being interested in the junior work of these two branches.

The following are a few methods used in imparting this knowledge to the people:—

(*a*) Winter short courses held in local communities lasting from one to two weeks, and covering the studies of field crops, soils, live stock, and home economics.

(*b*) Special educational trains traversing the State, on which are discussed such subjects as mealie culture, hog raising, dairying, and domestic science.

(*c*) Farmers' institutes, boys' judging contests, boys' camps, farmers' picnics, etc., are supervised by the Extension Department.

(*d*) Experimental and demonstration work on county farms is conducted by the department.

(*e*) Dairy test associations are formed by the department.

(*f*) Organizations, such as agricultural clubs, farmers' co-operative organizations, etc., are established.

(*g*) Schools, both secondary and common, county superintendents' and teachers' institutes are held.

(*h*) Junior work with boys and girls is carried on.

(*i*) Publications, such as bulletins, circulars, leaflets, and score-cards, are issued and distributed by the department.

(*j*) Correspondence covering all sorts of questions pertaining to the farm and home is answered.

From the above enumeration of work it becomes evident at once that the department is working together with every agency that will help to make better farms, homes, and people. The result of this co-operation is seen in the following brief summary of one year's work in the State of Iowa, which has a population of about two millions.

People reached by the department through short course classes, 11,613; short course night meetings, 12,000; short course exhibit cars, 10,000; farmers' institutes, picnics, etc., 14,100; special trains, 75,000; junior contest, 70,000. Grand total, 129,713.

The above does not take in the thousands reached indirectly through the department's literature in form of bulletins, circulars, etc.

The Extension Department teaches things which have been tried out and have given satisfactory results. For instance, it advocates that every farmer should test his seed mealies before planting. It also advises farmers to improve their cows by eliminating the poor ones by means of the Babcock test. These few examples give a general idea of the instruction and advice given along all lines of farm work. The department does not teach phenomenal things; for instance, "to graft a strawberry plant on a milkweed and get as a result strawberries and cream," but it is merely placing emphasis on the known facts in farming which if carried out would add millions of pounds to the annual net income of the country.

With the above general idea of the scope and nature of the work the reader will better understand the following brief explanations of the different branches of work done by the department.

SHORT COURSES.

The short course is no doubt the most important line of educational work carried on by the department. A great many of these are held throughout the State. A force of about twenty-five experts is occupied in this work. Mealies and small grain judging; rotation of crops; soils; care, judging, and managing of live stock; dairying; horticulture and domestic science are the principal subjects taught, although practically all subjects pertaining to farm life are discussed. For tuition fee, the men pay 15s., while the women pay 10s. for the entire course lasting from one to two weeks; classes usually begin 8 a.m. and close 5 p.m. each day. The writer had some experience in teaching at a short course in the winter of 1911. The plan followed was as follows: In the farm crops section every student is furnished with a tray of ten ears of mealies for study purposes. The sample contains ears with all kinds of defects, such as immaturity, sappiness, mouldiness, lack of uniformity, etc. After a lecture has been delivered on these points the sample is carefully studied with the help of the score-card. After this the sample is placed with the best ear ranking first and so on.

In the live stock section the same plan is followed. The object of this is to emphasize the important points to be looked for in judging work of any kind. All kinds of live stock, as horses, sheep, hogs, and cattle, are studied and judged the same as in the case of the grains. Judging work of any kind is of the greatest importance, as it develops observation, comparison, decision, and trains the eye to see any default existing in whatever is judged. Besides all this work, lectures are given in soil management, poultry management, dairying, farm machinery, and many other things.

In the domestic science section the women and girls are taught the principles of cooking, sewing, hygiene, sanitation, ventilation, and every subject that will assist in making better homes. The teaching of these farmer wives and daughters how to cook foods properly in several ways has a far-reaching influence, because it means better cooked foods, a more varied diet, a more cheerful home, better health for the family. This all helps to promote the idea of making farm life a pleasure rather than a drudgery.

The greatest pleasure, as the writer's experience has taught him, in teaching short course is that the pupils are all interested in the work; they are conscientious in their efforts and waste very little time, and consequently give their work the best attention. The keen manner in which they question the lecturer showed that they were making the best of their opportunity and were anxious to learn all they could.

The pupils attending such a short course vary very much in age. Not infrequently you find an old grey-headed farmer of over the sixties attending the course with some of his sons and may be with some of his grandsons, the youngest one perhaps not over ten years of age. The writer remembers meeting an old veteran of the American civil war. This old gentleman said that "he had been attending short course for the last twelve years and that every time he learnt something new about farming of which he never dreamt before." It is indeed a very interesting sight to see these strong, healthy farmers come from far and wide to attend the course. When people come such great distances it must be that they are deriving a great deal of benefit from it.

As has been mentioned before, the courses offered were eminently practical; each was designed to deal with some problem that confronts the farmer of to-day. The farmer prefers practice to theory. For instance, when the subject of seed mealies selection was discussed the lecturer concretely used the particular seed under discussion. A tray of mealies containing ten ears was given to each pupil. The pupils were required to test their knowledge of germination of seed by estimating what percentage of each ear will grow. After doing that the lecturer gave an illustration how to test seed mealies by a certain method, and the pupils were then asked to prepare their own testers and test the ten ears in front of them the same way as was shown by the instructor. This bit of practical instruction aroused quite an interest among the farmers.

Treating oats for smut was shown likewise in a concrete way and was much enjoyed by the pupils. Quite often practical farmers who have had success in growing seed mealies or lucerne, etc., are asked to give talks or present papers before these short course students. In this way there is an interchange of ideas and practical suggestions among the farmers themselves. The benefits that accrue from such a short course attendance are enormous; the farmers return to their farms and put into practice what they have learned, and as a result better crops are grown and better animals raised. These short courses are usually held during winter when the farmers get the least work to do. In order to secure the holding of such a short course it is necessary that a certain percentage of the farmers living in that community sign a petition requesting the department to hold such a course. The little expense in connection with the course is defrayed by the farmers

themselves. The staff of instructors is paid by the State, and so there is not much expense.

SPECIAL EDUCATIONAL TRAINS.

For the last few years special maize, soils, hog, and dairy trains have been run on the main lines throughout the State. The trains are sometimes called the "farmers' school on wheels," stir up a great deal of interest and enthusiasm, and are a very effective and efficient way of reaching the people. These trains are well advertised, so that when they arrive at a station hundreds, even thousands, of farmers are anxiously waiting in order to hear the "gospel of agriculture." These trains usually convey the best specimens of whatever is being lectured about, whether mealies, dairy cattle, or swine. The best men in the State are secured to give talks or lectures at the various stopping places. From ten to fourteen stops are made daily for two weeks. It is often very difficult to get farmers to go to political meetings, but just tell him that a special agricultural train is coming his direction and he will leave his cultivator or plough in the field and go to the nearest station in order to learn something more about his profession. The railway companies in America are always willing to give trains gratis for such purposes. The benefits from such agricultural trains are immense.

INSTITUTES, PICNICS, BOYS' CLUBS, AND AGRICULTURAL SHOWS.

About six members of the department are kept busy at farmers' institutes during autumn and winter. This is considered an important line of agricultural educational work among the rural population.

School, county experiment station, and farmers' co-operative picnics occupy a great deal of time during the summer months. Talks, or better lectures, on live stock, farm crops, domestic science, and co-operation are given on such occasions. Boys' judging contests are sometimes held in connection with them. The farmers' picnic is fast becoming a factor of social and educational importance. A member of the department is usually invited to conduct such picnics and to give lectures at such gatherings. Judging live stock and grains at county and districts shows is considered part of the programme of the Extension Department. The work is made educational by the practice of giving explanations for the decision of the judge. As a rule, the farmers are always well satisfied with the decision of these expert judges of the department.

COUNTY EXPERIMENT STATIONS.

Demonstration and experimental work in mealies and oats production has been conducted and carried on in connection with county farms. As a result of this work a great deal of valuable material on various questions pertaining to these cereals has been gathered. Samples of seed are secured from hundreds of farmers. These seeds are planted next to each other, receive the same care and treatment, and thus give the farmers a splendid opportunity to see how his seed compares with that of his neighbour across the fence. This kind of work is the cause of many a convert to the true gospel of agriculture. The results obtained from this experimental work are of great value on account of the care exercised in conducting it.

DAIRY TEST ASSOCIATION.

The American farmers realize the importance of the dairy industry. They also realize that the only way for the farmer to

improve his dairy cows is to weigh and test the milk of each cow at certain regular intervals. This is necessary in order to find out what his cows are producing; whether they bring him any profit or whether he is merely boarding them. All this can be done at a reasonable expense by organizing what is called a test association and hiring a competent man to do the work. About twenty farmers co-operate and form one of these associations. In this way the cows of each farmer are tested once every month. The benefit derived from such organization is obvious.

SCHOOLS.

The best way of reaching the largest percentage of boys and girls upon farms with information on agriculture and domestic science is through the medium of the country school. The Extension Department is doing a great deal in promoting the idea of having agriculture taught in the country school. The need of teaching agriculture and domestic science in public schools is obvious if we take into consideration that only a fraction of one per cent. of the pupils of schools ever attend college. Already much is done in the United States of America to get agriculture in the public rural schools. The development of this line of work is of the greatest importance as it affects the rising generations of the nation.

JUNIOR WORK.

In the State of Iowa, United States of America, seven thousand boys and girls are taking special work in mealie growing, gardening, and domestic science. This work is done according to directions sent out by the Extension Department. The competition among these youngsters is strong in the annual contest and exhibits held at short courses. A couple of years ago the highest yield of mealies produced per acre by one of these boys engaged in this kind of work was 118 bushels, or in South African measure 38 bags. This boy has consequently done a noble work by getting four times as much as the average yield of the mealie belt of the States. He has demonstrated to the farmers the possibilities of mealie culture in the States. The boys in the different counties carrying on this work, obtaining the highest yield, were given a free trip to Washington, and had the honour of being the guests of the President for a few days. The girls who had won in the cooking and sewing contests were given the same privileges. In America the question is not how to arouse interest for this work among the youth, but to get help enough to keep up with the demands for this kind of work among the people.

ORGANIZATION AND CO-OPERATION.

Probably the greatest need among our farmers to-day is organization. The rural people need debating societies, clubs of various kinds, and organizations that will "boost" for better agriculture and the welfare of the farmer.

Hand in hand with organization goes co-operation, without which not much can be done to promote agricultural interests. The "working together" of the farmer and the business men in towns in the States is noteworthy. The business men are ever ready to assist financially and personally in all kinds of work like the organizing of a short course, giving premiums for contests and exhibits, etc.

The Press also lends valuable assistance by using their papers to advertise and consequently make more successful short courses,

institute work, and special agricultural trains. They also open their columns generously for disseminating information that helps towards the upbuilding and bettering of agriculture throughout the country.

The above brief sketch of the different branches of work carried on by the department gives a general idea of the scope of the work. The prejudice some of the farmers had at first against agricultural experts has died away long ago. The American people have wakened up and are demanding agricultural education. The Extension Department with its staff of energetic bright men is the powerful machine that is revolutionizing the agriculture of to-day. Through the efforts of this organization more agricultural products are produced, better men and women are made, and happier homes are being established.

May the day soon dawn when in the Union of South Africa we will have such a powerful force at work which will revolutionize agriculture in our country the same as was done in the United States of America!

Rural Notes.

Sir Stewart Stockman.

South African farmers generally, and Transvaalers in particular, will have read with interest and satisfaction the announcement in the daily Press that among the New Year honours is the knighting of Mr. Stewart Stockman, the Chief Veterinary Officer of the British Board of Agriculture, who was formerly Principal Veterinary Officer of the Transvaal Department of Agriculture. Sir Stewart Stockman, M.R.C.V.S., has been Chief Veterinary Officer to the British Board of Agriculture and Fisheries since 1905. He was Professor of Pathology and Bacteriology at the Royal Veterinary College, Edinburgh, from 1892 to 1899, and served in the South African war and in the Indian Civil Veterinary Department. He was appointed Principal Veterinary Officer of the Transvaal Department of Agriculture in 1903, and held the post for two years.

Saltpetre Lick for Lamziekte.

Some correspondence has recently taken place between the Government Botanist and Mr. L. S. Meintjes and Mr. W. A. Schulze, of Setlagoli, British Bechuanaland, on the subject of lamziekte, which should prove interesting to many readers of the *Journal*. These gentlemen have experimented with licks for their cattle with what results will be seen from a perusal of the letters which follow. Mr. Schulze used a salt lick suggested by Mr. Meintjes. He writes: "The lamziekte question being of such vital importance to the whole of South Africa, I think it my duty to acquaint you with the undermentioned facts in connection with the disease. I am farming on about 8000 morgen of land approximately five miles from Setlagoli, and was, until six weeks ago, entirely free from lamziekte. I did not know what it was, and only heard about the disease from my neighbours. . . . I run about 400 head of cattle. Nine of them took sick within twenty-four hours. Just that day when this was reported I read a letter of Mr. L. S. Meintjes advising us to put down a saltpetre lick. This I did the following day, with the result that I saved six of the nine sick cattle. I have not the slightest doubt that the other three head would also have been saved had they not been too far gone. They were already down to it and could not move about any more. I am positive these three head had none of the lick. I departed from Mr. Meintjes' recipe in this way; instead of using his full quantity of saltpetre, I am using half each saltpetre and glauber salts, thus making up the lick as under:—

50 lb.	Saltpetre.	Well powdered.
50 lb.	Glauber salts.	Well powdered.
100 lb.	Bone meal.	
600 lb.	Cattle salt.	

The reason of my adding glauber salts was being under the impression that adding some ingredient to the lick to assist the beasts' motions was bound to do good, though Mr. Meintjes disagrees with me in this. I have, however, always added glauber salts to the lick and have not had a single case since I lost the three head previously mentioned. The lick also seems to improve the general health and condition of the cattle, as mine are looking exceptionally fit for this time of the year."

Lamziekte and Nitrates.

Mr. Meintjes started out with this theory: "That cattle suffered from insufficient nitrates in their system during the dry periods, and by supplying that deficiency it will in some measure prevent cattle from assimilating the poisonous nitrates contained in wilted plants." He experimented on this basis last season and continued when lamziekte again started this year. The following are the results of the experiments in Mr. Meintjes' own words: "Last season I gave some 300 cows with calves a lick composed of 400 lb. salt, 100 lb. bonemeal, and 100 lb. potassium nitrate. Not a single animal in that lot contracted the disease. The disease again started with us in September this year in a very severe form. I then gave the lick to all cows and a lot of oxen, in all, 1026 in number. This lick they have had since the 3rd October, and there has not been a single case of the disease in that lot up to date now for two months. I had not sufficient potassium nitrate to give the lick to all the cattle, so decided that until fresh supplies arrived a troop of heifers (not served) running on Sherwood and a lot of oxen on Elibank (793 in number) should wait, and, in the meanwhile, act as controls. In this lot of cattle there were six cases in a very short space of time. On the 3rd November all cattle on this property were supplied with the lick, and, to date, there has not been a single case of gal-lamziekte. It may be of further interest to you to know that on Sherwood we had only one case of the disease last year among the young heifers. Elibank, again, on which the oxen are running, is a farm recently enclosed and the veld ungrazed, yet the disease appeared there.

"Some reason must be attributed," Mr. Meintjes continues, "to the presence of the disease on Sherwood this season and its absence last year. I account for it in this way: Sherwood is probably the heaviest timbered farm in Bechuanaland with camel-thorn trees. For ages past it has been a place where cattle have been watered in the Setlagoli River. Old kraals and cattle posts are dotted all over the place. At these places there are large camel-thorn trees bearing an enormous number of pods. These pods fall in the late autumn and early spring, and cattle go for them ravenously. While last year the trees were laden with pods, this year there are hardly any to be found owing to drought. The pods, as a pulse, must contain a certain amount of protein, and, in my opinion, act through their nitrogenous composition as a preventive against lamziekte. Let the theory worked on, or the conclusions arrived at, be what they may, the fact still remains that, with the use of potassium nitrate, we have kept over 1800 cattle free of the disease through a period during which it was

exceedingly prevalent and the losses on farms immediately adjoining us abnormal. In all instances when potassium nitrate was used the disease stopped suddenly and the continued use prevented its reappearance. . . . What is perhaps most striking is the marked improvement in the condition of cattle since receiving nitrates. Our cattle even in this drought look as well and healthy as I have ever seen them even in the best of seasons." In the course of his reply to Mr. Meintjes, Mr. Burtt-Davy, the Government Botanist, said: "Owing to the sporadic nature of the disease, I think one must await the results of continued treatment with your lick before being able to say positively that it is the cause of the improvement noted. If nitrates act as a preventive, it does not necessarily follow that the disease is caused by the lack of nitrates."

In a further communication, Mr. Meintjes writes: "Whatever may be said of the sporadic nature of the disease, we had it here, and with the putting down of potassium nitrate licks it stopped. I cannot believe that it is only a coincidence that we should be wholly free of the disease while our neighbours were sustaining heavy losses. On the farm Togisi, which cuts into this block of ground, the owners have lost over fifty per cent. of their cattle this season. Mr. Schulze, at Setlagoli, was losing his cattle from lamziekte when I advised him to adopt the potassium nitrate lick, and with him the disease also stopped and he has not had another case. The Smartt Syndicate has now adopted the lick, as also the De Beers farms at Kimberley. It would be interesting to note what success they will have with it. . . . I have maintained all along, and still maintain: (1) That certain plants grown under great heat with insufficient moisture have the peculiarity of accumulating toxic substances, and quote kaffir corn as an instance. (2) That the poison which produces lamziekte is contained in wilted grass. So far, I think, both you and Dr. Theiler agree with me. I go further and say: (3) That the effect of this poison on the animal is to cause a suspension in the flow of the animal secretions which produces all the complications found in cases of lamziekte. (4) That in early detected cases, by promoting an increased flow of the animal secretions, the poison is carried off and the animal invariably recovers. This is as far as I discussed the subject with Dr. Theiler, as you will see by the correspondence in his office.

"We now come to the present stage of the subject," Mr. Meintjes proceeds. "In every case where death has resulted from lamziekte which I have examined immediately after death I have found, in addition to the usual symptoms, congealed blood in the heart, the bladder so distended with urine as to fill the whole of the pelvic cavity. I have also had several cases where the bladder had burst. In adopting potassium nitrate, all this was taken into consideration, as well as supplying a deficiency of nitrates in the animal's system. The results are so convincing that I had no hesitation in placing the information before the Director of Veterinary Research. With years of experience I know the condition of the veld which produces lamziekte too well to be mistaken, and I am positive

that were it not for the use of the potassium nitrate we would during the past two months have had an abnormal number of cases of the disease. I know of nothing that will so effectively remove an excessive accumulation of bile from the gall bladder as potassium nitrate. I have tried it in several cases, but three are worthy of record. In May last we imported, with some heifers, six Coates shorthorn bulls. Three of the bulls contracted biliary fever, which resulted in pronounced jaundice. Every visible part of the skin, even to the whites of the eyes, was yellow. Repeated doses of potassium nitrate had the effect of preventing the bile from being reabsorbed in the blood stream, the animals quickly regained their natural colour, and made a rapid recovery. . . . If it is your intention to publish my success with potassium nitrate as a preventive for lamziekte," Mr. Meintjes concludes, "emphasis should be laid on the following points: The lick must not be made to contain a smaller proportion than 1 of potassium nitrate to 6 of salt; 1 in 4 is better. Sufficient troughing must be provided for every animal to get at the lick without having to fight its way. The troughs must be so placed as to give every animal an opportunity of getting a lick daily. We have licks at every watering place. There are over 200 feet of troughs, and to this I am adding another 160 feet."

Ermelo Stud Sheep Farm.

The public sale of stock bred at the Potchefstroom Experiment Farm, to which we referred last month, was followed by a sale at the Ermelo Stud Sheep Farm of a number of bulls bred there. The sale was naturally upon a smaller scale, but the following statement will show the trend of prices realized. The purchasers' names are also given:—

Breed.	Purchaser.	Price.
Fries	Lamb	66 guineas.
Do.	Loxton	58 ,,
Aberdeen-Angus	Zeederberg	54 ,,
Do.	Sturgess Bros.	48 ,,
Do.	Woodhouse	54 ,,
Do.	Verveen	58 ,,

Although the Stud Sheep Farm at Ermelo is a less ambitious institution than the Potchefstroom Experiment Farm, some very useful work is being accomplished, and we have by us some interesting evidence of this. A farmer in the Standerton district, who obtained some young Wanganella rams from the farm, writes to say that these have clipped as follows:—No. 373, $19\frac{5}{8}$ lb.; No. 328, $15\frac{1}{2}$ lb.; No. 330, $20\frac{1}{8}$ lb.; No. 378, $21\frac{5}{8}$ lb.; No. 345, $20\frac{1}{8}$ lb. He observes: "I am very pleased indeed with them, and especially with their clip and weight of wool. Everybody who saw them before they were clipped admired them." Mr. Mallinson, the Principal Flock Master, considers that these clips are as good as any which would be obtained from rams of the same age bred from the best flocks in Australia.

Wool from Ermelo.

The General Manager of the Ermelo farm, too, has received an interesting communication from a firm of wool brokers who recently

disposed of a quantity of wool on behalf of the farm, as follows:— " . . . Lot 1.—The bales of AA fleeces attracted a good deal of attention. The wool was very well grown, showing an excellent length of staple, and was of good quality. It is a wool of splendid spinning quality, running into 64's. The wool was well skirted, being in nice, light, and clean condition. It was a most attractive wool and commanded the keenest competition of the buyers at our sale. We might say that the price of 12d. is very full value, as such wools are secured for special purposes of manufacturers in Europe. It is a typical Australian wool, and we shall be glad to hear whether this wool was grown on your farm at Ermelo. The buyers freely expressed the opinion that the wool was the best seen in this market."

South Devons in Natal.

Congratulations are due to Mr. W. J. S. Newmarch, of Harden Heights, Natal, a prominent wattle grower, on his enterprise in importing a number of pedigree South Devon cattle for his wattle farm. These arrived some months ago, and arrangements are now being made to have them registered in the South African Stud Book. The pedigrees of these animals (which consist of one bull and six heifers) are as follows:—(1) Bull, Daisy's Pride (ear clip 82): 4032; calved 12th April, 1911; sire Myrtle Pride (3237); dam Daisy Bell (3837); breeder, W. H. Pain, High House, Kingsbridge. (2) Heifer, Bluebell 2nd (ear clip 44): 9879; calved 14th March, 1910; sire Primley Admiral (2988), by Good Sort (2378); dam Bluebell (6489); grand dam Cherry 3rd (3740). (3) Heifer, Gentle 3rd (ear clip 45): 9881; calved 4th April, 1910; sire Primley Admiral (2988), by Good Sort (2378); dam Gentle 2nd (4893); grand dam Gentle (3741). (4) Heifer, Mabel 15th (ear clip 94): 9973; calved 28th March, 1910; sire Marathon (3213), by Layman (2406); dam Mabel 11th (7760); grand dam Mabel 8th (4926). (5) Heifer, Countess 12th (ear clip 95): 9970; calved 29th March, 1910; sire Marathon (3213), by Layman (2406); dam Countess 11th (7759); grand dam Countess 10th (6525). (6) Heifer, Milk Maid (ear clip 10): 10216; calved 29th May, 1910; sire Surety (3058), by Layman (2406); dam Warwell Cherry 3rd (7174); grand dam Cherry (4968). (7) Heifer, Buttercup (ear clip 11): 10214; calved 20th May, 1910; sire Surety (3058), by Layman (2406); dam Primrose (7979); grand dam Daisy (6707).

A Word on South Devons.

South Devons are one of the divisions of the Devon breed of cattle. They differ materially from the North Devon types, being larger, coarser, and not so deeply coloured. It is possible that these differences, and also their great milking powers, were acquired by crossing long ago with Channel Islands cattle, although this is by no means regarded as an established fact. "Since the end of the eighties in last century," says Professor Wallace, "the South Devon cattle have been steadily asserting themselves as a distinct breed. They have been growing in favour as general purpose animals for the production of both meat and milk, and their development in type and quality has been a subject of remark at the leading shows. They

have extended in considerable numbers into the counties contiguous to their home centre and into the Midlands, and they have been increasingly shipped to South Africa, South America, and the United States." Their powers of milk and beef production may be estimated from instances cited by Alfred Michelmore (*Live Stock Almanac*, 1903):—" Six cows from the herd of R. E. Cocks, of Ranleigh, near Plymouth, produced during one period of lactation an average of over 969 gallons per animal, whilst another cow from the herd of J. Sparrow Wroth, of Coombe, near Kingsbridge, in 261 days produced 1047 gallons of milk, being an average of over four gallons per day." A steer from Coombe, sold at £32. 4s. at Smithfield, "under two years of age, was 1190 lb., showing an increase of 1.78 lb. per day."

The Bacon Industry.

Three years ago Mr. Loudon M. Douglas, of Edinburgh, the well-known technical adviser on bacon curing, the meat industry, and modern dairy practice, issued a memorandum indicating the then unfortunate condition of the bacon-curing industry of the United Kingdom, and wherein it was shown that a great opportunity existed for the development of swine husbandry and bacon-curing in Great Britain. In a further memorandum which he has just issued, Mr. Douglas observed that the warning then issued was not appreciated by the agriculturists of Great Britain, but that many foreign countries at once proceeded to take advantage of the situation. As a consequence, new bacon factories have since then sprung up in different countries in Europe, notably in Russia, and there has also been a very great development in bacon-curing in China and the Far East; all with a view to supplying the British markets. "But," observes Mr. Douglas, "notwithstanding the increase in the sources of supply, the shortage still continues, and there is still the same necessity for British agriculturists to organize bacon-curing establishments throughout the United Kingdom. The available figures are, indeed, very alarming. In comparing the two periods from January to November, 1911, and from January to November, 1912, the pig products imported into the United Kingdom were as follows:—

Period from 1st Nov., 1912 to 9th Nov., 1912. Cwts.	Period from 2nd Jan., 1911 to 11th Nov., 1911. Cwts.
4,053,684	4,219,946
802,728	846,822
194,286	206,921

which shows a steady decline. We find also that in the United States, with its 50,000,000 pigs, there is a great shortage as against last year, in which is called the western packing area, which includes Chicago. The shortage over the year as compared with the similar period a year ago amounts to 1,810,000 pigs."

South Africa's Opportunity.

The cause of this shortage is very difficult to ascertain, as it would appear to be general throughout what have hitherto been recognized as the principal pig-producing countries. In the United Kingdom the shortage is partly due to the disinclination of farmers to

taking the risk of breeding pigs under the present stringent conditions of inspection. The unfortunate outbreak of foot-and-mouth disease in Ireland has also contributed very largely to the scarcity of pigs and the consequent rise in the price of bacon and pig products. "The difficulties, indeed, of pig-breeding increase from year to year," says Mr. Douglas, "as the only remedy which seems to be available, when one pig in a herd is suspected of having swine fever is the prompt slaughter of the whole herd." Mr. Douglas proceeds: "That there is a future for swine husbandry and bacon-curing in the United Kingdom cannot be denied, as we pay to oversea nations £25,000,000 or thereabouts every year for pig products, a large proportion of which could quite well be produced in this country. It is quite true that in some districts a happier view of the future of swine husbandry prevails, and bacon-curing factories are being organized in different parts of the country. Greater industry, however, prevails overseas, and the latest competitors for British trade are as far away as East and South Africa and Australasia. There is no reason why the British Colonies should not supply the United Kingdom with bacon and pig products. At the present time we import enormous quantities of butter from our Colonies, and as swine husbandry is carried on whereever butter is produced, the one business is the natural corollary of the other."

A Mistaken Award.

At the Central Agricultural Society's show held last April at Bloemfontein, in Class 150, for the best cow in milk, the first prize was awarded to Messrs. Grepe Brothers' South Devon cow, and the second prize to Sir George Farrar's Friesland cow, Boukje. Sir George Farrar has now received a letter from the Secretary of the Central Agricultural Society from which it appears that, owing to an error in the calculation of the judges' figures, a mistake was made in the award; the first prize should have been awarded to Sir George Farrar's Friesland cow, and the second prize to the South Devon cow. Mr. Johnson, the Secretary of the Agricultural Society, writes:—"Sir George Farrar's cow, Boukje, gave, in the morning's milking, milk yielding 0.573 lb. of butter-fat, and in the evening 1.159 lb. The total of these was given as 0.732 lb. instead of 1.732 lb. Hence this cow is entitled to an additional pound of fat, the value of which, according to scale, is 20 points. The total points gained by her should therefore be 118.45 instead of 98.45. As the cow to which the first prize was awarded scored 111.17 points, it follows that Sir George Farrar's cow should have been awarded the first prize. The judges have examined their figures again and agree that this error was made. My committee, while expressing their great regret that such a mistake was made, are unable to rectify it now, as the judges' certificate awards Boukje only second prize, but I am instructed to inform you that you may make whatever use you like of this letter."

Permanent Pastures.

"Begin with little things and don't accept a failure or a success until you have checked it." Such was the useful advice to farmers which Sir Percy Fitzpatrick offered at the Dry-Farming Congress

held recently at Bloemfontein. Sir Percy was discussing the establishment of pastures on the dry farm, and his advice was good. He pointed to a luxuriant stool of *Phalaris bulbosa* that stood on the platform. "That," he said, "failed with me three or four times; it does not fail now." Sir Percy said he too believed the future of South Africa was on the dry lands, but no one could dogmatize and lay down rules. What was good in one district was not good in another; a man might make a success of a crop in one part of his farm and not in another—even in one part of a field and not in another. This had been proved time after time. All he could do to-day would be to suggest certain lines on which to make their own experiments. "Work at your experiments persistently, observing everything," he said. "The seasons, the soil, the seed, the treatment, introduce numberless factors, but there are certain things in common, and those we can talk about." Sir Percy proceeded to give some very useful advice, founded upon his own experience. "So frequently," he observed, "people say: 'I want a grass that will stand rough treatment and does not require molly-coddling.' Well, that is all right, but must not be applied to experiments. First get the grass to grow; give the experiment every chance; do not kill what you are experimenting with. Some people buy valuable seed and scatter it over the veld. Well, that is a first-class thing to do—for the seed merchant. Remember you are laying down permanent pasture, a pasture that is to last for ever, and, at least, you should take as much trouble over it as you would devote to wheat or mealies—a crop that lasts only a year."

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Preparing Soil for Pastures.

Preparation was everything, Sir Percy proceeded, and men would be wise if they thoroughly prepared the soil; there could be no short cut to success. He had some figures supplied from Australia, which showed that for dairy purposes land was there bought at £5 per acre. The land was ploughed and cross-ploughed, a green crop put in, and after two years' work and wait, seed to the value of £2. 10s. per acre was put in. Before a single cow was put upon it the land had cost £7. 10s. to £12 per acre, and they reckoned its value for dairy purposes at £20 to £25 per acre. Our land is at least as good," said Sir Percy; "our conditions are better; we can do the same." Sir Percy read a list of twenty-seven grasses he had tried at Harrismith and Johannesburg. Out of that number six had been selected, and would probably be reduced to four or even three. For all grasses it paid to cultivate thoroughly and prepare the ground well. It paid well to water it if they could. It paid well to fertilize. It paid to fertilize old paspalum pasture with basic slag or bone meal—it paid well, but it was not necessary to have either water or fertilizer. Too many people made the initial mistake of laying down too great an area of pasture. It was far better to lay down a smaller area and give it the very best attention. He had 2000 acres of exotic grasses at Harrismith; no irrigation was done, but the rainfall was good. From January to October the rainfall had been: January, 2.35; February, 11.18; March, 2.14; April, 4.08; May, 0.75; June, 0.17; July, 0.12; August, 0.01; September, 0.24; October, 0.47.

Grasses for the Dry Farm.

Sir Percy found *Phalaris bulbosa* to be the best drought resister. Grown without water in the red soil on his Johannesburg farm it was making growth on the 15th June, and never turned a leaf in a frost of 10 degrees. It had had no water except the rainfall, and none of that since March. Two and a half years ago he brought a stool of *Phalaris* away from the Harrismith farm, broke it into four, gave three away, and broke the remaining piece into single stems, each with a root. The specimen on the platform was one of those, and it measured over eighteen inches square at the root. Tall fescue was the best all-the-year-round grass for conditions of frost and drought, but they should be careful not to get the European variety. *Paspalum dilatatum* was the best drought-resister for the summer, and *Paspalum virgatum* was also a good summer grass for cutting and as a substitute for lucerne where the latter would not grow. Cocksfoot was a splendid grass where there was moisture and shade, but it became stunted by drought. It was a splendid grass for orchards, but for real dry-land farming not as good as tall fescue. Speaking of the differences observable in plants of the same variety, Sir Percy said that in tall fescue tremendous differences would be noticed—short plants and tall, light green and dark, broad leaves and narrow, some more drought-resistant than others. Had they fescue or phalaris, let them take out the best plants, break them up, and replant them in single lines. "You may find your salvation or the salvation of your farm through such variations or through a sub-family. The work is interesting, but it wants the personal, intimate, unceasing attention of the man who is going to pay for it."

Treatment of Pasture Soils.

In all cases new ground was better than old lands to grow these grasses on, said Sir Percy, because it was clear of weeds. If they could get old ground that was perfectly clean he would not say that it was not better, but it was difficult to get. Even Paspalum was badly handicapped in his experience for a year, or even two or three years, by sweet and quick grass, but when once thoroughly established it would crowd out everything else. It was better to put grass down in new lands, in order to avoid the weeds. In preparing thirty-two acres of ground for *Phalaris bulbosa*, he ploughed and disked it until quite fine; cross-ploughed, drag-harrowed, and rolled, then drilled in the seed. The work cost £29, including 8s. per acre for the first ploughing; the seed was charged at £25, although half of it was grown on the farm and cost nothing; fertilizer £19, or a total of £75 for the thirty-two acres—that was £2. 5s. per acre. Everything was charged at current rates. The other extreme in cheapness was paspalum. New ground should be ploughed and planted with mealies, 10 lb. to the acre. When the plants are three inches high the ground should be harrowed and sown with paspalum. The mealies with three to five bags to the acre should pay for everything, including the fencing of a 100-acre paddock. Scattering the seed on the veld or in disked land was only waste. Paspalum should be sown only in the springtime, as it would not germinate until it had the right combination of heat and moisture.

The Seed Question.

The cost of *Phalaris bulbosa* seed, Sir Percy proceeded, was 5s. per pound, and care was necessary in the matter of seeding. Although the cost per pound was heavy, only 2 lb. to 3 lb. per acre was necessary, and if one happened to strike a good season 1½ lb. to the acre was sufficient, although it took some mixing with other stuff in order to get it through the drill evenly. Stools of phalaris grew to from 12 to 18 inches in diameter, and should have room to grow out. Cocksfoot, at 10d. per pound, registered 20 lb. to the acre. *Paspalum dilatatum*, at 10d. per pound, required 10 lb. to the acre. A farmer could save his own grass seed if he began with a small plot and worked up. At the present price tall fescue cost 30s. an acre in seed. It would pay to grow ten acres especially for seed. It was easy for the boys to cut off the heads with a sickle and throw them on a buck-sail, and in twenty-four hours the seed could be "tapped" out. The germination of home-grown seed was much higher than that which they might buy. That was also his experience with phalaris. Let them give their experiments every chance. No book could ever tell them what would do well on their farms; that they must find out for themselves. Sir Percy advised the disking of paspalum every two or three years; it would double the crop. "You can even plough it up," he said, "and you will get a magnificent crop within two months."

How Grasses Justify Themselves.

Sir Percy gave some interesting experiences as showing how grasses would justify themselves. From May to October there had been no rain at Harrismith, for instance, or nothing worth counting, but to-day his horses, cattle, and sheep were feeding on paspalum that had come this spring with no rainfall. The stock was improving, and so was the grass. In a paddock of 150 acres which was as bare as the floor on the 1st August (1912), shoots began to appear, and during September that paddock contained 100 head of cattle; they had been there for the whole month, and both grass and cattle were improving. If the best value was to be got from paspalum it must be fed right down to the ground, and the same with phalaris; never let it grow tall; as it grows feed it right into the bellies of the sheep. In January, 1911, there were in the same paddock of 150 acres (the seed was sown in the previous March and very little came up until the September rains, when it continued coming till January): 90 yearling heifers, 20 cows, 23 mules, 60 mares and foals, 40 oxen, off and on, and odd horses. They fed in the 150-acre paddock for six weeks; although the grass was only four months old they could not keep it down, and still it went to seed. One paddock of 70 acres contained two-thirds tall fescue and the rest sheep's burnet and cocksfoot, put in in March, 1911, on soil that was good but not of the best; 900 sheep were put into it during May, June, and July, and they picked up well. A 40-acre paddock (horse paddock fed off all the year round), never saved, had 450 sheep put into it for three winter months. On none of this land could more than one sheep to the morgen have been kept in condition at that season of the year before being put into grass. Sir Percy concluded his valuable lecture with the advice: "It is only when you pay for your failures yourself

that you know what failures are like. There is something in failure that you can never get back—you will never get back the year you have thrown away. Learn through the experience and mistakes and failures of others where you can."

Teff and Maize.

The honour of introducing teff grass to the farmers of this country on a practical scale is due to Mr. Joseph Burtt-Davy, the Government Agrostologist and Botanist, and, thanks to his untiring efforts, this valuable fodder crop is being sown in increasingly large areas not only in the Transvaal but in other parts of the Union as well. Hundreds of farmers are now laying down this crop, and some considerable individual areas are being sown. We learn, however, that Mr. W. A. McLaren, the well-known genial "steam-plough man" of Vereeniging, has beaten the world's record for teff sowing for one farmer. Mr. McLaren has put down 1500 acres of teff grass this season, and the crop is looking splendid. If he harvests only one ton to the acre he will have a phenomenal hay crop which should keep all his stock in excellent condition, should it be our unfortunate fate to have to go through another winter and spring like the last. Mr. McLaren has, however, not only excelled himself in this one direction. In spite of the drought he has been able to plant a full 6000 acres of maize, which is a South African record for steam-plough work. Mr. McLaren has never quite reached this figure in previous years. Touching this matter of ploughing in a dry season, we have also received some interesting data with regard to Mr. C. Hamilton's operations at his farm, Pruisen, Potgietersrust. Writing on the 22nd December, Mr. Hamilton says:—"I ploughed about 100 acres last winter 15 to 20 inches deep and sowed Eureka mealies after the first rain last month. The crop is looking grand, and I must say I have never seen such a good stand before. I have always ploughed as deeply as I could in the winter time, generally about 9 inches. I could not hit on a plough that would go deeper, but last winter I tried a Rud Sacks 'Settler's Friend.' Where possible I ran a Howard's sub-soiler *before* the Rud Sacks and then got down 18 to 20 inches, and when I could not get the sub-soiler in the big plough did about 15 inches. The sub-soiler took ten oxen and the Rud Sacks twelve or fourteen. In future I only intend to plant mealies on deep winter-ploughed land."

Orange Growing in the Transvaal.

Mr. A. Jonnes, Brits, writes:—"It is not generally known what a wonderful outlook the Transvaal and South Africa generally has in the future of the citrus business. There are certain localities which have been proved to be especially suited to orange culture, but as water is not available everywhere it follows that not all the lands suitable are able to be planted, for water is very necessary to the citrus during our dry winter. The best belt known in the Transvaal is situated along the northern slopes of the Magaliesberg Mountain range, where the decomposed ironstone, washed down for thousands of years, makes the finest soil for producing fruit of the best flavour. Hitherto all the

oranges grown (with few exceptions) have been eaten locally, but now that the Horticultural Division of the Department of Agriculture have opened the eyes of the people to the fact that London alone consumes £12,000 worth of fresh fruit every day, and that we can get our oranges there in the hottest weather—May to August—when folks clamour for something juicy, it follows that we have a market not only able to take all we can send, but ten times as much as we can possibly export for many years to come. The orchards of citrus suitable for export trade are few, as it is only quite recently growers began to understand that to ship they must grow varieties wanted in London. The Washington Navel has all over the world proved itself the best shipper and keeper, and nurserymen are being put on their mettle to supply the demand for young trees. In addition to the population of London we have all England and the Continent, so that we can figure on supplying 80,000,000 to 100,000 000 people in the near future. This, to the uninitiated, may sound 'tall talk,' but when you remember that only two countries south of the Equator grow oranges—Africa and Australia—which ripen in the season when all Spanish fruit is over, it will be seen that we have a market all our own so to speak, as Australia can never be a serious competitor of ours in the European market, for the reason that distance and freight bar the door to her for citrus.

"In the new mail contract just fixed up by the Union Government," Mr. Jonnes continues, "freight on citrus has been specially reduced up to 25s. per ton of 40 cubic feet. At that rate oranges sent to London leave a handsome profit to the grower, but it must be understood that the old style of slinging 100 fruit into a box and nailing on the lid will never make a sale in London. They demand good, sound fruit, packed neatly, without bruises, so that growers on this side would do well to remember fruit must be handled with care, as a bruise here means a soft, rotten spot by the time oranges are opened in London thirty days after being picked from the tree. To show what price London will pay, we might mention that sound, selected navel oranges packed in small, flat boxes as prime fruit realized up to 4s. per dozen *wholesale* in London not long since. Of course, that price cannot be expected for whole shipments, but it will give an added stimulus to the man looking for big returns to make sure he has opportunity, if he will only attend to the condition of his shipments. Business men are realizing, perhaps even more than the old style of growers what the future outlook means, for we find several big places being laid down with thousands of trees for export trade alone. Good citrus lands with water sufficient for trees may be purchased in the neighbourhood of £3 to £5 per acre, according to soil, etc., while those laid out are finding buyers up to £12 and £15. Lands in California, which is considered to be the home of the orange, have sold up as high as £200 per acre, so it does not take much calculation to make a big claim for South Africa. There is not the slightest doubt that a man starting with, say, a capital of £3000 or £4000 has an absolute fortune ahead of him which nothing can stop.

"If he can buy a place ready planted with the right stuff," Mr. Jonnes concludes, "then he could look to good returns at once, but

most of the men planting now are not desirous of selling their properties—the outlook is too good—and it is quite useless buying an orchard laid out with seedling variety if one intends exporting to foreign markets. Here and there, of course, places may be had where the owner is making a change, but the instances are few and far between. Our Government expert has expressed the opinion that London alone can take all the Transvaal or South Africa can send for the next twenty years, but the oranges must be the right sort, and properly packed and shipped. Is there any country in the world which has such an outlook? All we can grow at a good price and no competitors. Just think of it, some of you men with money lying idle! There are many points which it is not possible to touch in the space of a short note like this, but passing mention may be made of some of the side lines in the citrus business. Look at the enormous quantity of marmalade imported into the country from oversea every year; the candied peal used by housewives and confectioners, the essence of lemon, essential oil, lemon squash, and so on. Does it not seem that we should be ashamed of ourselves to import thousands of pounds worth of goods per annum which can be produced within our borders quite easily and so keep the money in the country? Mining may be the industry which, at the moment, bulks more largely than anything else, but it will not always be so, and there can be little doubt that agriculture is the real backbone of the country. Mealie growing has been pushed along as something at which money can be made, but we must remember we have always enough competition in the ports of the world to keep profits from being extravagant. Nothing like that can be said of oranges, and should we not grow the things we know are waiting to be snapped up at a high price rather than tinker with products which have to fight hard for a price?"

Electricity and Animal Growth.

The experiments carried on by Sir Oliver Lodge near Evesham, England, to test the stimulative effects of electricity on growing crops are fairly well known, and the results, so far as certain forms of vegetable life are concerned, have been satisfactory, a considerable addition to the yield having been secured by the use of electric currents set up by overhead wires. These observations suggested that electricity might be found equally stimulating to animal growth, and in the *British Medical Journal* reference is made to a report on experiments on these lines carried on by Professor Silas Wentworth, of Los Gutos, California, at his experimental farm on a ranch near Roseville. The report states that a flock of 2000 sheep was divided, one half being placed in a field under the power wires of an electric wire company, while the other half were removed from electric influences. In the field under the electric power line the production of lambs averaged a fraction over two lambs to each ewe. In the adjoining field where electrical influence was lacking the lamb average was rather less than one to each ewe. The fleeces from the sheep in the electrically influenced field proved 20 per cent. heavier. Professor Wentworth thus claims that the electric influence on animal life "will more than double the production of lambs and generally increase the yield of wool."

Articles on Dairying.

The articles published lately in the *Journal* on butter-making and other dairy subjects have excited a good deal of interest. All the indications point to increasing interest on the part of our farmers in dairying, and the industry is progressing steadily. The increasing number of creameries points to this, even if we go no further afield; and their establishment, in turn, is proving not the least potent factor in the building up of an important industry. A correspondent in Natal recently suggested the publication of an article on the making of cheddar cheese, embodying information suitable for the South African farmer. We are pleased to be able to announce that the Superintendent of Dairying, Mr. E. O. Challis, in conjunction with Dairy Inspector Carruthers, is now preparing an illustrated article on this subject. Some little time must elapse before it is completed, on account of the complicated processes of cheese-making which will have to be illustrated, but as soon as it is ready it will be published in the *Journal* and thereafter issued in pamphlet form. Those interested in cheese-making will note with satisfaction that an additional instructor in cheese and butter making has been appointed to the staff of the Superintendent of Dairying.

Outbreaks of Animal Diseases

We are asked by the Veterinary Division to correct a mistake which inadvertently occurred in the compiling of the list of outbreaks of tuberculosis in the Orange Free State during the month of October (see November *Journal,* page 790). In the published statement an outbreak of tuberculosis was reported on Bainsvlei and Van Zyls Dam, Bloemfontein District; instead of Bainsvlei "the leased portion of Bainsvlei" should be read. The outbreak occurred among pigs.

Ministerial and Staff Changes.

So far as the portfolio of Agriculture is concerned, the Cabinet changes which took place in December have resulted in a reversion to anterior conditions, the Right Hon. General Botha, P.C., Prime Minister, having resumed control of this office.

Mr. F. B. Smith, Secretary for Agriculture, left for Capetown on the 7th instant, where he will remain until Parliament rises.

Mr. C. B. Hardenberg, Entomologist, proceeded to Natal early this month for the purpose of investigating the insect pests affecting the wattle industry of that Province. His headquarters will be at New Hanover.

Mr. Claude Fuller, Natal Entomologist, stationed at Pietermaritzburg, is being transferred with his staff to the headquarters of the Division of Entomology at Pretoria.

Mr. E. Harrison, Lecturer in Agriculture at the Grootfontein School of Agriculture, Middelburg (Cape), has been appointed Principal of the School of Agriculture at Cedara, Natal, a post which was rendered vacant by Mr. E. W. Sawer's resignation a few months back.

Correspondence.

This section will be set aside for correspondence on all subjects affecting the Farming Industries of the Union of South Africa and cognate matters; and, while every reasonable latitude will be allowed, contributors are requested to be as concise and succinct as possible in the expression of their views.

Suggestions for practical consideration and discussion, and hints as to improved methods applicable to any branch of agriculture will be particularly welcome.

It must at all time be distinctly understood that the Department of Agriculture is in no sense responsible for the views and opinions expressed in this section.

All communications should be clearly addressed "The Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria," and written on one side of the paper only.

WIRE-WORM IN SHEEP.

To the Editor of the *Agricultural Journal.*

SIR,—In reply to your note at foot of article in October number of the *Journal*, "Wire-Worm in Sheep and their Treatment," by Dr. Arnold Theiler, I give you my experience in the hope that same may be tested properly and proved beneficial or otherwise. I had a small flock of yearling lambs badly infested with wire-worm. Several had died from the complaint; others were in a very emaciated condition, all visibly infected. I mixed a lot of salt and water in troughs and gave to the flock, with the result that about six died from drinking too much. These were examined, and the fourth stomachs were full of wire-worm, but all dead. I then made the salt water very much weaker and continued the treatment. I also added a small quantity of slaked lime, and as the sheep became accustomed to the drink gradually increased the quantity of salt in the troughs until it was so strong that the water did not quite dissolve all the salt. I lost no more sheep out of the flock, and at the end of six weeks there was not a single sickly sheep in the lot. All had put on flesh and were in good condition and apparently in perfect health. The flock ran in a camp where they had no access to any other water, and as I had to cart the water for the troughs I only gave the sheep a drink about three times a week. If the above will cure wire-worm under all conditions it will be a great boon to farmers, being simple and inexpensive, so I trust the Veterinary Department will put it to the test and let us have the result in your journal.

A. C. McDONALD, Jun.

P.O. Upper Zwaart Kei, via Tarkastad, C.P.

[The above letter was referred to the Acting Director of Veterinary Research (Mr. Wm. Robertson), who replies that he knows common salt is an excellent remedy for worms, and that he will try the method adopted by the writer as soon as he has an opportunity.]

SCOUR IN CALVES.

To the Editor of the *Agricultural Journal.*

SIR,—In the *Agricultural Journal* for February, 1911, I saw an inquiry by A. B. Anderson, Kaffirskraal, Standerton, about scour in calves, and also the reply. I only want to say that it is a disease that sometimes causes great loss. Formerly I also lost calves through scour, but not now. As soon as it is noticed that a calf is sick, take a piece of tobacco, 2½ or 3 inches long, cut it, put it in ½ pint of warm water, and allow it to draw. Before using, strain it. Dose the calf half an hour before allowing it to suckle.

My calves do not get water before they are six month sold. They are kept in an enclosure, where they have shade, and there get salt and also grass. When they are six months old I allow them out during night-time. Those are the healthiest and fattest calves.—Yours, etc.,

G. P. J. VAN ROOYEN.

Cinderford, P.O. Vants Drift,
Dundee, Natal.

TYPE OF SHEEP FOR KRAAI RIVER.

To the Editor of the *Agricultural Journal.*

SIR,—As a beginner, allow me to obtain some advice about sheep through the medium of your valuable journal. My greatest difficulty is to decide which particular type of Merino sheep will be most suitable to local environments, whether the Saxon, Spanish, Wanganella, or Tasmanian Merino. My farm is situated along the Kraai River. The veld a mixed grass veld, sour grasses predominating, and the soil a red sandy loam. The average rainfall about twenty-four inches per annum. To me it appears as though the tendency of the wool is to become finer, and heavy yolked sheep (Saxons), which I thought would develop tar tops, became almost white after running on the farm for some months. Will you kindly explain what caused this change in the appearance of the wool? The sheep I refer to had only been dipped once in Cooper's Dip. Having now given the conditions to which the wool is exposed, I should like to know further whether a fine or robust woolled sheep would suit the climatic conditions best.—Yours, etc.,

D. C. NAUDE.

Roodewal, Aliwal North.

[The Principal Flockmaster (Mr. C. Mallinson) replied as follows:—I would advocate strong-woolled Wanganellas with plenty of crimp, as they will throw out the dust and keep a good top. I do not know any sheep except the Vermont or Vermont cross which is likely to give you what you call a tar top, but I think the best thing you can do is to try Wanganellas. You can increase the yolk content by proper feeding. The whiteness of your wool is evidently due to unnutritious food.]

ANOTHER SUSPECTED CAUSE OF LAMZIEKTE.

Mr. C. J. van den Berg, residing at Middelplaats, Kuruman District, reports through the Magistrate at Kuruman that he considers he has discovered the cause of lamziekte.

He states that for some years past he has always kept his large stock upon veld which was not grazed upon by any small stock, and that while so kept they were free from the disease. Latterly he has allowed the small stock to graze upon the same veld, and since then the disease has made its appearance amongst his cattle. He states that he has noticed the same occurrence on two separate occasions many years ago while he was farming in the Cape Colony, and is of opinion that the small stock infect the grass with some germ which is prejudicial to cattle.

[The Government Botanist replied as follows:—Though the observation is doubtless correct, I fear that the conclusion drawn from it is fallacious. We have had exactly the opposite experience in dozens of cases; many farmers find that where their veld has been grazed short by small stock the disease rarely or never occurs; this is the case on the native reserves in the Vryburg Division.]

TAGASASTE AS A STOCK FOOD.

To the Editor of the *Agricultural Journal.*

SIR,—Can you give me any information as to the value of Tagasaste for feeding purposes, and if it prospers under South African conditions? Also, what is the best means of securing its germination, as I have tried on several occasions and failed, although the seed was kept moist, and in one case had first of all been treated with boiling water.—Yours, etc.,

INQUIRER.

Thaba 'Nchu, O.F.S.

[The Agronomist, Department of Agriculture, Bloemfontein (Mr. E. J. Macmillan), furnished the following note in reply:—A trial made with this plant at the Tweespruit Experimental Farm showed that it was a strong grower, resisting frost and drought. The tender shoots are readily eaten by stock. The chief obstacle to its general cultivation as a fodder plant is the difficulty in establishing it. The seeds are very slow to germinate; soaking the seed in boiling water is recommended to produce a quicker germination. The plants are most readily started in nursery beds or tins, from which they can be transplanted as required. As a fodder shrub, Old Man Saltbush is superior to Tagasaste, and ordinary lucerne is more worthy of attention even on dry lands.]

VLEI SOIL.

To the Editor of the *Agricultural Journal.*

SIR,—As a reader of your journal I ask you kindly to inform me if you can give me some advice *re* black turf soil (vlei) I have on my farm at Turffontein West, Johannesburg. The ground has been lying idle for the last four years, but I started working same last August for vegetables. After giving plenty horse manure and tilling the ground well, also watering twice a day, I can grow practically nothing; even the small onions and lettuce bought from others and transplanted on my ground will not grow, as the roots turn dry and yellow. My servants tell me the ground is too sour. Can you please give me some remedy?—Yours, etc.,

A. KLEINKRAMER.

P.O. Box 4895, Johannesburg.

[The Manager of the Government Experimental Orchard at Potchefstroom (Mr. W. A. Sturm) replied:—From the description it is hard to judge the reasons of failure. To be able to do so the following must be known: (1) The mechanical conditions of the soil; (2) the chemical components; (3) the subsoil; (4) the drainage condition. Vegetables require for their best development a friable soil, allowing their roots to range freely through it; if the soil is not naturally in a friable condition it must be brought by thorough cultivation and manuring into that state. Some of our vlei soils are of a very stiff consistency and require a great amount of labour and expense to bring them into fertile condition. Such soils are greatly improved by a liberal application of lime and heavy dressings of fresh horse manure, and, if practicable, the addition of sharp sand. Lime should be applied several months before manure is incorporated with the soil. If both are applied together, the lime will volatilize the nitrogen of the manure, which of course is then lost. This treatment will also be beneficial in the case of sour soils—that is to say, soils containing an excess of humus, which develops carbonic acid gas. From correspondent's description it would appear that his soil contains some alkali, but as under this name so many substances are classed by the layman, it is impossible to give a remedy without an analysis. However, liming and liberal manuring, combined with thorough cultivation, generally suffices to overcome this evil in most of our soils. One very important factor to consider is the drainage. In order to ascertain whether a soil is sufficiently drained, dig a hole about three feet deep and fill in with water. If after twenty-four hours the water has disappeared, then the drainage is efficient; if not, means must be resorted to to effect a thorough drainage. Without knowing all the circumstances it is impossible to say exactly what is wrong. It may be that the horse manure was in too fresh a state for the young lettuce and onion seedlings, which, the latter especially, require the manure to be in a very decomposed form. Cabbages and cauliflowers would have answered better in this case; these also stand a greater amount of alkali than lettuces and onions. The above remarks must be taken generally; the best plan would be to have a representative sample of your soil analysed.]

SUMMER WHEAT AND OATS.

To the Editor of the *Agricultural Journal.*

SIR,—I would consider it a great favour if you would give me information on the following subject. I have heard that the Rhodesian Government is experimenting with summer wheat and oats, with what success I cannot say.

I would like to try them, as it will now be too late to plant mealies; we usually get a frost on or about the 1st May. If you would give me the name of variety most suitable, where it is procurable, also let me know if there is any other quick-maturing grain I could sow, I would be obliged.—Yours, etc.,

HUGH M. BISSET.

P.O. Sepani, via Bloemfontein.

[The Agronomist, Department of Agriculture, Bloemfontein (Mr. E. J. Macmillan), replied:—Both wheat and oats grown during the summer season are liable to suffer from rust and cannot be recommended in the average season in the Free State. A trial might be made with Bobs Wheat, which is one of the quickest to mature and is fairly resistant to rust. Seed is obtainable from dealers. In oats the old variety known as Boerhaver is one of the most suitable. Seed should be procurable from local seedsmen. Experience has shown that a paying return in grain is very improbable from a summer crop, and it seems better to use the available land for growing fodder such as Teff Grass and Millet (Japanese is one of the best). Chester County Mammoth Maize if planted at once, with no early frost, should produce a crop of grain. Otherwise the stems may be used for fodder.]

STOOLING OF MAIZE.

To the Editor of the *Agricultural Journal.*

SIR,—Will you kindly let me know whether mealies can stool—each seed planted giving three to five stalks—and at the same time give a good crop?

We have a small plot very heavily fertilized (Safco mealie manure). The plants are two feet high and are all stooling.

Also, should a mealie stalk bear more than two full-sized cobs?—Yours, etc.,

E. V.

Carolina, Transvaal.

[The Government Agrostologist and Botanist (Mr. J. Burtt-Davy) replied as follows:—In the case of Flint breeds of maize such as Cango, Botman, Wills Gehu, etc., the plants often stool freely and bear several good ears on one plant, and sometimes more than one ear ("cob") on a stalk. In the case of Flour-corns ("Brood mealies") it may be the same. But with Dent maize (Hickory King, etc.) it is not found desirable to allow more than one stalk to develop on a single plant; it is the same in the States, and it is there customary for the farmers to pull off the "suckers"; this can be done where labour is cheap or the acreage small, but it is not practicable on large areas of maize. On the average soils of the Transvaal it is usually found that it is better to develop one good ear ("cob") on a stalk rather than two, which are usually poor. On very well-fertilized soils, however, it is sometimes possible to develop two good ears on a stalk, but this is the exception.]

CINQUANTINA MAIZE.

To the Editor of the *Agricultural Journal.*

SIR,—In the *Farmer and Stockbreeder* (England) of the 14th ultimo, Mark Lane prices for grain are given, and under the heading of maize the following varieties are quoted:—

	s. d.		s. d.
Round, per 480 lb.	27 0	to	29 0
Yellow ,, ...	25 0	to	26 0
White ,, ...	31 0	to	32 0
Cinquantina ,, ...	35 0	to	36 0

Can you inform your many readers if "Cinquantina" maize is suitable for or is grown in South Africa, and if it is an early and drought-resisting grain? The great difference in price, if a heavy cropper, should draw the attention of our maize gowers to that variety.—Yours, etc.,

G. D. SMITH.

Middlekop, Vryburg.

[The Government Agrostologist and Botanist replies:—The present price of Cinquantina is abnormal; it usually brings only 6d. to 1s. per muid more

than Flat White. We have tried it repeatedly, but the yield is so poor and the crop so expensive to harvest that we gave it up as unsuited to our conditions. Wills' Gehu is better.]

PATCHY CROPS ON OLD FOREST LAND.

To the Editor of the *Agricultural Journal.*

SIR,—I notice on this farm a singular feature for which I cannot account, and will be glad if you would allow me, through the medium of your valued columns, to lay the matter before your readers in the hope that some suggestions as to cause and cure may result. On some lands, being burnt-out forest soil, we have sown oats and wheat, and find patches, in the oats particularly, on which the stuff comes up and thrives luxuriantly for about a fortnight or so and then suddenly burns to a rusty yellow and dies off. These patches appear indiscriminately all over the ground and appear to my mind to mark spots where some particular species of forest trees have stood. I have spoken to several on the matter, and, while being conversant with the effect, they can not suggest a cause. It would appear from the experience of others that even manuring is useless on these spots. Some produce, again, thrives there. It appears to have no effect on beans, and wheat is but slightly affected and even gets over it. It has been suggested that these patches mark the spots where the White Els grew. The patches differ in size, some being two yards in diameter, others larger. Could any of your readers advise me in this connection, both as to cause and cure? Trusting to be favoured with the views of you or your readers,—Yours, etc.,

V. P. FRANZSEN.

Loredo, P.O. Plettenberg Bay.

[Mr. Franzsen's letter was submitted to the Chief Conservator of Forests, who replies:—It is difficult to offer a reason for the occurrence without an inspection; I can, however, not see what White Els could possibly have to do with the phenomenon, and would suggest that a sample of the soil be subjected to analysis.

Correspondence from other readers who have also noticed the phenomenon is invited.]

REMOVAL OF TREE STUMPS.

To the Editor of the *Agricultural Journal.*

SIR,—Through the medium of the *Journal* or otherwise, kindly advise me as to the best and cheapest means of removing stumps of trees.—Yours, etc.,

J. H. HUMAN.

Pypwater, P.O. Keegas.

[The Chief Conservator of Forests (Mr. J. Storr Lister) replies as follows:—Stumps are usually removed by means of axes, saws, wedges, crowbars, etc., or by the aid of machines. The principal part of the work is that of grubbing out the stump; this usually takes 70 to 90 per cent. of the labour involved in the whole operation. The work is commenced by digging all round the stump and exposing all the side roots. All these roots are then severed close to the stump. The workmen then continue to dig round the side roots or the top root until the upper parts are exposed and can be severed or extracted with the stump. Another way, after the roots have been exposed, is to split the stump into pieces and extract these separately; for this purpose iron crowbars are used, or the stump may be blown up with gunpowder. A useful implement may be made by utilizing the services of a screw-jack in the following manner. A screw-jack should be placed in an upright position next the stump and a strong and stout pole laid with one end on the jack and the other on the ground. A strong chain passed round the pole should be securely fixed to the stump and the jack operated until the pole is raised and the stump extracted by leverage. In this case the side roots should be severed before the jack is placed in position. A very useful machine called the "Forest Devil Stump Extractor," which does cheap and expeditious work, is occasionally obtained from various firms, but owing to lack of demand it is not usually in stock.]

SORREL OR STEENBOK ZUURING.

To the Editor of the *Agricultural Journal*.

SIR,—I have got sorrel into my lands, and, as you know, this awful weed kills all grass, etc., that it comes in contact with. I wonder if you can suggest a way of getting rid of the sorrel? It was introduced here by seed from the Cathcart District, where it has ruined thousands of acres of ground. The Dutch name for sorrel is steenbok-zuuring, and I understand it is very prevalent in the Western Province.—Yours, etc.,

JOHN G. LAING.

P.O. Navar, via Indwe, C.P.

[The Principal, School of Agriculture, Grootfontein, Middelburg, C.P., replied that he has carried out a number of experiments in the eradication of sorrel, but none of them has proved of practical value except good cultivation. The use of arsenite of soda, salt, etc., proved useless unless one used those materials in such quantities as to render the cost prohibitive. "In the Western Province, where this weed first started, before it was transferred to Cathcart, the people found the only way to keep the weed in check is to plough and cultivate constantly during the dry or non-growing season. This gives the ensuing crop a chance. In fact, when it has been possible to leave the land fallow for two or three years, and the cultivation has been carried out constantly before the plant has seeded, the land has practically been cleared."]

TO DESTROY CONVOLVULUS.

To the Editor of the *Agricultural Journal*.

SIR,—Can any of your readers inform me whether there is any way of destroying convolvulus in land otherwise than ploughing it in while young before it has begun to creep? Thanking you in anticipation,—Yours, etc.,

CHAS. GRAY.

Mgela, Bergville P.O., Natal.

[We know of no other method of eradication. Perhaps some of our readers can assist correspondent with advice.]

RESCUE GRASS.

To the Editor of the *Agricultural Journal*.

SIR,—I am forwarding herewith a specimen of grass which is growing in my garden and which is wonderfully drought-resistant and does not seem to be affected by frost. Will you please advise me as to what it is called, or whether I am wrong in supposing it to be tall fescue?—Yours, etc.,

T. C. WRIGHT.

Box 143, Germiston.

[The Government Agrostologist and Botanist (Mr. J. Burtt-Davy), to whom the specimen was submitted, replied as follows:—The grass sent is not tall fescue, but the rescue grass (*Bromus willdenowii*), a nutritious, winter-growing grass, much liked by stock, but one which does not usually succeed with us under veld conditions. It seems to require shade and moisture and some cultivation to make it successful. It is a dangerous grass in lucerne fields, as it grows luxuriantly in winter and is said to choke out the lucerne; it has proved very troublesome in lucerne in the Fish River Valley. The seeds are, also, injurious to ostrich chicks.]

PUMPING MACHINERY.

In reply to an inquiry by J. H. Human, Pypwater, P.O. Koegas, as to the most suitable machinery for raising water from the Orange River to irrigate twenty morgen, the Director of Irrigation writes:—The most suitable plant for raising water from the Orange River to irrigate twenty morgen is a suction gas engine, driving a centrifugal pump, if there is plenty of wood on the farm. Charcoal can be made which would be used as fuel for the suction gas plant. If charcoal is not obtainable, then anthracite coal must be used. A pumping plant with a capacity of 200 gallons per minute would be required to irrigate twenty morgen with a three-inch watering working ten hours per day for twenty-one days.

The Weather during November.

By C. Stewart, B.Sc., Chief Meteorologist, Department of Irrigation.

Along the coast line and in the extreme south-west of the Cape Province, both day and night temperatures were one degree below the normal, but inland the heat was severe, the mean day temperatures having been five degrees and the night temperatures two degrees higher than usual. In the Transvaal the day temperatures recorded reveal a mean of about seven degrees above normal.

Except in the extreme south-west of the Cape the rainfall during the month was considerably below the average, the greatest deficit having been in the Transvaal. In the Cape the total precipitation was only 48 per cent., in the Orange Free State 57 per cent., in Natal 67 per cent., and in the Transvaal 42 per cent. of the usual amount. The considerable shortage in the year's rainfall and the resulting serious check to agriculture has therefore been further aggravated.

For a number of stations within the summer rainfall zone the following data enable comparison of the drought of 1897 with that of the present year. It will be seen that this season's drought is generally more severe, having been intensified by a greater failure in precipitation during the latter half of the preceding season :—

Station.	Rainfall 1st July to 30th November.			Rainfall 1st January to 30th June.		
	1912.	1897.	Normal.	1912.	1897.	Normal.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Komatipoort	0·94	—	5·08	—	—	—
Louis Trichardt	1·74	—	6·52	—	—	—
Johannesburg	2·57	5·75	7·25	14·26	19·73	17·25
Zeerust	1·17	—	5·34	—	—	—
Pretoria	4·83	—	7·66	—	—	—
Mbabane	7·12	—	13·11	—	—	—
Bloemfontein	1·76	3·53	5·49	9·79	1[illegible]·26	14·68
Durban	5·75	13·40	15·82	15·09	16·40	19·48
Vryburg	0·79	0·58	3·06	14·04	9·21	19·28
Pella	Nil.	Nil.	1·92	0·80	2·60	3·86
Hopetown	0·09	0·11	2·74	8·82	8·83	9·40
Murraysburg	0·21	1·11	2·81	4·34	6·16	7·85
Aliwal North	1·22	1·59	6·16	12·51	10·94	15·81
Queenstown	1·62	0·90	6·65	11·25	4·77	14·60
Kokstad	2·89	2.29	7·90	15·41	17·80	14·84
Umtata	2·35	3·08	8·66	9·93	17·54	13·63

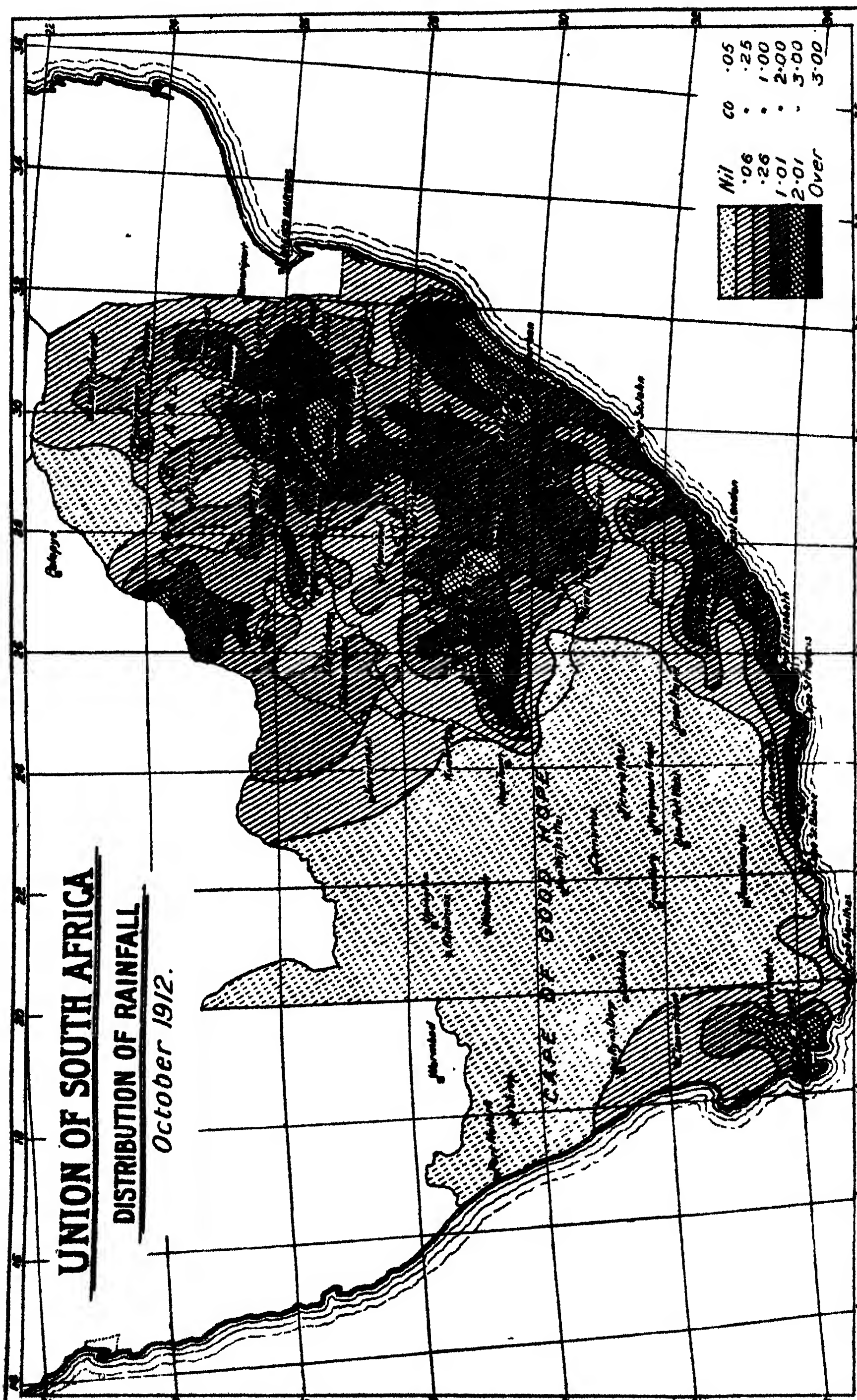
On 24th November high winds prevailed over the Transvaal and some damage resulted. This was followed by a general cold spell over the high veld.

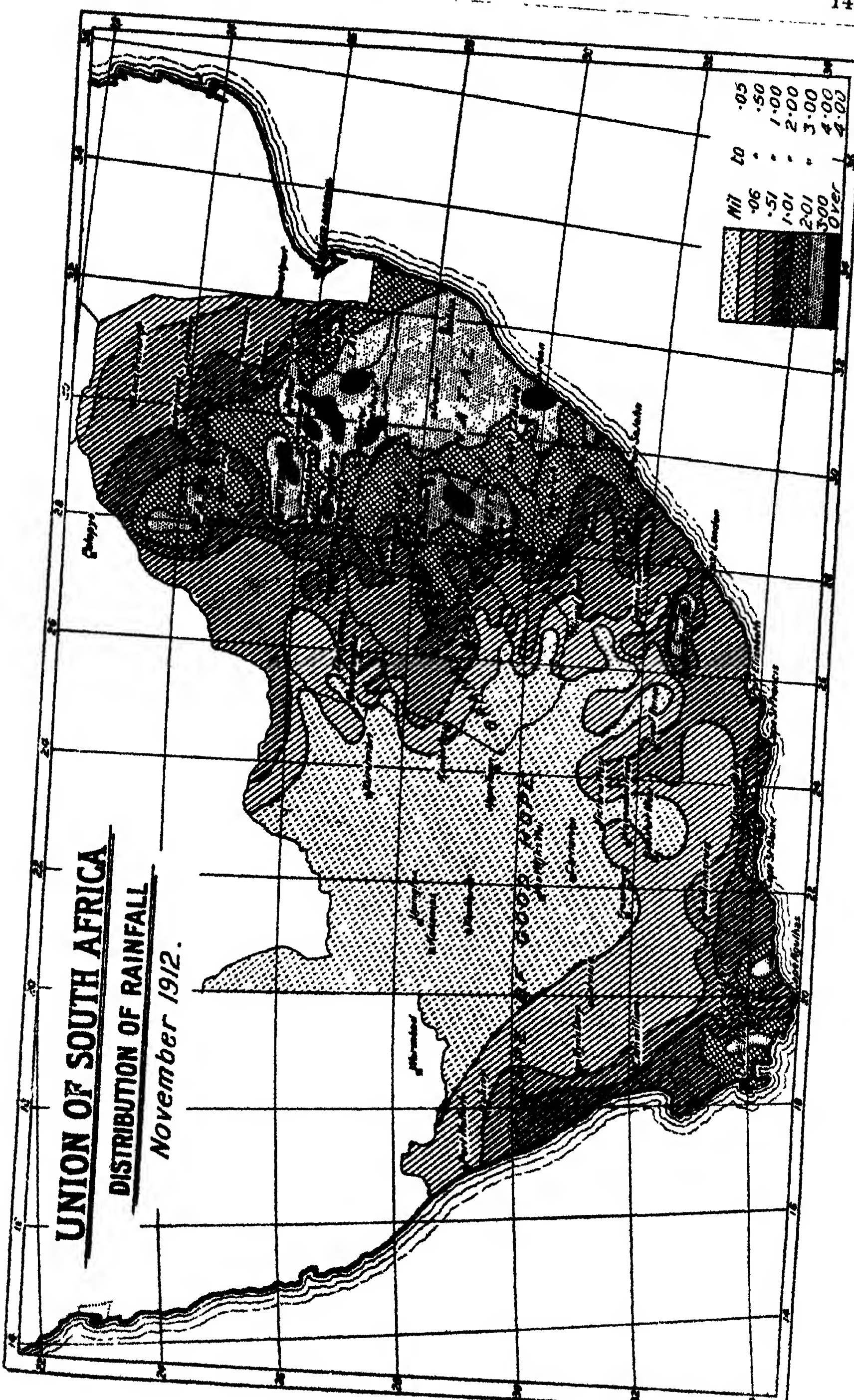
OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN THERMOMETER SCREENS)—NOVEMBER, 1912.

Place.	Observer.	Month—November, 1912: Mean Max.	Mean Min.	Monthly Temperature.	Normal Monthly Temperature.	Difference from Normal.	Extremes: Highest.	Date.	Lowest.	Date.
		°	°	°	°	°	°		°	
Transvaal—										
Louis Trichardt	Sergt. J. C. N. Clark ...	91·0	62·1	76·6	69·0	+7·6	104·1	24th	51·0	18th.
Pietersburg	W. Frankleyne	83·4	59·4	71·4	68·5	+2·9	98·0	9th & 24th	50·0	18th.
Belfast	G. J. Imrie...	77·6	50·7	64·2	61·3	+2·9	86·4	9th	39·0	25th.
Zeerust	H. Dietrich, J.P.	93·2	61·8	77·5	71·9	+5·6	100·3	23rd	46·5	25th.
Pretoria (Arcadia) ...	J. Lyall Soutter	90·8	59·0	74·9	69·2	+5·7	97·8	8th	46·3	25th.
Johannesburg (Observatory)	Staff	81·8	57·2	69·5	63·0	+6·5	88·0	13th & 21st	44·1	17th.
Potchefstroom	J. R. Henning	91·2	59·0	75·1	67·5	+7·6	98·1	9th	40·0	25th.
Christiana	S. W. Davis	93·6	58·8	76·2	72·0	+4·2	104·0	14th	41·0	11th.
Komatipoort	B. J. Fothergill	96·4	67·4	81·9	76·9	+5·0	114·5	24th	55·0	17th.
Swaziland—										
Mbabane	A. C. Hulett	82·1	54·1	68·1	64·5	+3·6	94·0	24th	41·0	17th.
Orange Free State—										
Bloemfontein	H. Arndt	85·8	58·9	72·4	67·7	+4·7	96·0	12th	42·7	25th.
Lindley	J. Oates	86·0	55·1	70·6	66·2	+4·4	95·0	12th	37·0	25th.
Harrismith...	J. B. Patterson	78·3	51·2	64·8	64·1	+0·7	89·4	12th	33·0	25th.
Natal—										
Durban	Government Chemist ...	76·2	62·1	69·2	72·8	—3·6	89·0	5th	54·5	18th.
Maritzburg	Natal Asylum	85·7	57·1	71·4	69·1	+2·3	106·0	12th	43·0	25th.
Dundee	Gaoler	86·8	57·4	72·1	69·3	+2·8	97·0	13th	46·0	17th.
Hlabisa	E. D. Lightening	84·3	63·2	73·8	—	—	100·0	5th	55·0	16th, 20th, & 21st.
Cape—										
Aliwal North	A. Brown	85·4	48·9	67·2	65·4	+1·8	95·0	20th	30·0	25th.
Kokstad	H. D. Coyte	80·4	51·6	66·0	63·5	+2·5	95·5	12th	35·0	25th.
Murraysburg	A. Cameron	83·8	50·9	67·4	65·3	+2·1	95·0	19th	36·0	24th.
Clanwilliam	W. J. Downes	83·6	52·3	68·0	69·4	—1·4	98·0	19th	44·0	10th.
Queenstown	H. Holley	83·3	51·6	67·4	66·8	+0·6	98·0	12th	35·0	25th.
Bedford	T. C. Hall	77·2	51·1	64·2	63·0	+1·2	103·0	12th	40·0	26th & 27th.
East London	M. G. Grogan	72·7	59·9	66·3	65·8	+0·5	78·0	22nd	51·0	25th.
Amalienstein	Rev. Carl Prozesky ...	81·5	51·4	66·4	67·6	—1·2	92·0	18th	41·0	9th & 10th.
Groot Drakenstein... ...	Lionel Baker	74·8	53·0	63·9	65·0	—1·1	91·8	19th	42·4	10th.
Capetown (Observatory) ...	Staff	71·5	55·1	63·3	64·2	—0·9	83·8	6th	43·9	1st.
Wynberg	Sister Mary Imelda ...	72·0	52·5	62·2	62·2	±	84·0	6th	43·0	10th.
Port Elizabeth	P. E. Morgan	71·9	57·7	64·8	65·1	—0·3	85·0	28th	50·0	25th.

RAINFALL RETURN FOR NOVEMBER, 1912.

PLACE.	OBSERVER.	MONTH.			YEAR.		
		Nov., 1912.	Normal.	Difference from Normal.	From 1st Jan., 1912.	Normal.	Difference from Normal.
Transvaal—		ins.	ins.	ins.	ins.	ins.	ins.
Komatipoort ...	B. J. Fothergill ...	0·31	2·25	—1·94	11·27	20·55	—9·28
Christiana ...	S. W. Davis ...	0·16	1·51	—1·35	17·02	16·02	+1·00
Belfast	G. J. Imrie ...	3·30	4·57	—1·27	19·99	26·07	—6·08
Pilgrims Rest ...	Trans. G.M.E., Ltd.	1·48	4·07	—2·59	22·41	34·43	—12·02
Zeerust	H. Dietrich, J.P.	0·42	3·31	—2·89	12·03	21·35	—9·32
Middelburg ...	Dr. H. A. Spencer	3·51	5·38	—1·87	21·83	24·49	—3·66
Potchefstroom ...	H. R. M. Bosch ...	0·67	3·13	—2·46	21·63	21·10	+0·53
Pretoria	J. Lyall Soutter...	3·57	4·53	—0·96	17·96	24·72	- 6·76
Rustenburg ...	SouthAfricanPolice	0·47	2·78	—2·31	13·30	20·98	—7·68
Standerton ...	A. van Backstrom	1·65	4·77	—3·12	18·39	26·88	—8·49
Johannesburg ...	Observatory Staff	1·51	3·65	—2·14	16·83	25·08	—8·25
Louis Trichardt ...	SouthAfricanPolice	0·56	3·11	—2·55	18·18	25·08	—6·90
Pietersburg ...	W. Frankleyne ...	1·37	2·45	—1·08	7·05	16·35	—9·30
Swaziland—							
Mbabane... ...	Swaziland Police	3·04	6·12	—3·08	30·05	41·81	—11·76
Orange Free State—							
Lindley	Jno. Oates ...	2·32	3·49	—1·17	22·53	21·94	+0·59
Harrismith ...	J. B. Patterson ...	3·49	4·48	—0·99	23·69	25·12	—1·43
Winburg... ...	J. J. Swartz ...	1·12	2·37	—1·25	22·78	20·74	+2·04
Bloemfontein ...	H. Arndt... ...	0·30	2·34	—2·04	11·55	20·17	—8·62
Natal—							
Hlabisa	E. D. Lightening	3·00	5·64	—2·64	32·71	33·44	—0·73
Dundee	Gaoler	3·12	—	—	—	—	—
Maritzburg ...	Govt. Asylum ...	3·65	3·97	—0·32	22·42	25·71	—3·29
Durban	Govt. Chemist ...	2·77	4·42	—1·65	20·85	35·30	—14·45
Cape—							
Mafeking ...	A. Robertson ...	1·01	2·73	—1·72	12·75	18·15	—5·40
Vryburg	J. T. Morrison ...	0·18	1·49	—1·31	14·83	22·34	—7·51
Pella	Rev. Bishop Simon	0·00	0·23	—0·23	0·80	3·18	—2·38
Kenhardt ...	A. E. Bowker ...	0·00	0·23	—0·23	3·47	5·25	—1·78
Griquatown ...	E. Hanstein ...	0·00	1·02	—1·02	4·81	13·03	—9·22
Hopetown ...	W. T. Golledge ...	0·00	0·98	—0·98	8·91	12·14	—3·23
Clanwilliam ...	W. J. Downes ...	0·27	0·32	—0·05	7·03	8·40	—1·37
Van Rhynsdorp ...	T. J. Shaw ...	0·14	0·21	—0·07	4·37	6·13	—1·76
Calvinia	W. Harvey ...	0·17	0·42	—0·25	5·00	7·74	—2·74
Fraserburg ...	P. J. Booyzen ...	0·00	0·58	—0·58	3·34	6·85	—3·51
Britstown ...	P. A. Myburgh ...	0·03	1·32	—1·29	11·42	10·97	+0·45
Carnarvon ...	J. Sullivan ...	0·00	0·62	—0·62	1·70	8·22	—6·52
Murraysburg ...	A. Cameron ...	0·02	0·96	—0·94	4·55	10·69	—6·14


UNION OF SOUTH AFRICA
DISTRIBUTION OF RAINFALL
October 1912.
Nil ·05
·06 ·25
·26 1·00
1·01 2·00
2·01 3·00
Over 3·00
CAPE OF GOOD HOPE


UNION OF SOUTH AFRICA
DISTRIBUTION OF RAINFALL
November 1912.
Nil to .05
.06 " .50
.51 " 1.00
1.01 " 2.00
2.01 " 3.00
3.00 " 4.00
Over 4.00

FEBRUARY WEATHER CHARACTERISTICS.

Except along the west coast where it is increasing, there is a marked decrease in the rainfall throughout the Union during the month of February. The eastern Transvaal with a normal of about 5·5 inches is now the venue of the heaviest precipitation, whilst the Transvaal high veld follows with slightly under 5·0 inches. In Natal and Basutoland 4·0 inches; in Kaffraria 3·5 inches; over the Orange Free State and the north-east and south-east of the Cape Province 3·0 inches; over the Cape northern border 2·0 inches; along the south coast and over the northern and east central Karoo 1·5 inches; and over the remainder of the Cape Province less than 1·0 inches may be expected.

The mean daily temperature is now decreasing inland, but over the coastal districts it is generally slightly higher than during the preceding month, and the yearly maximum is reached. The mean temperature usually experienced over the Cape northern border is about 77 degrees; over the southern Karoo 75 degrees; over the Transvaal low veld 74 degrees; over the east central Karoo 73 degrees; in the O.F.S., Natal, over the northern Karoo and the south-western and south-eastern districts of the Cape, and along the west coast 71 degrees; along the south coast and in Basutoland 70 degrees, and in Kaffraria and over the Peninsula 68 degrees.

The prevailing winds over the Union are from the north-east. On the high veld this is the cloudiest month of the year, the hours of bright sunshine in the Transvaal being now only 55 per cent. of the total number possible, whereas in the south-west of the Cape Province the percentage is 87, and is the maximum for the year.

Importation of Live Stock.

RETURN showing particulars of certain Pure-bred Live Stock recently imported into the Union of South Africa.

Stud-book Number or Name.	Breed and Stud-book in which registered.	Sex.	Country of Origin.	Importer's Name and Address.
HORSES:—				
"Fingask's Best," No. 17037	Clydesdale.—Stud-book Vol. 35	Stallion	Scotland	Andrew Kiddie, Kimberley (18/12/12).
"Klerc," No. 94972 ...	Percheron.—Société Hippique	"	France	George Graham, Trompsburg (14/12/12).
No. 29919	Shire.—Shire Horse Society Stud-book	"	England	Bloemfontein Corporation (23/12/12).
No. 64733	" " "	Mare	"	" "
No. 67814	" " "	"	"	" "
No particulars	English Thoroughbred.—Vol. XXII	Stallion	Gt.Britain	J. B. Morgan, Queenstown (17/12/12).
"Amyas," No. 15111 ...	Clydesdale.—Stud-book Vol. 32	"	Scotland	R. Morton, Lorraine, Bloemfontein (14/11/12).
No particulars	No particulars	"	No particulars	E. V. Birch, Dordrecht (20/11/12).
4 mares.—No particulars ...	" "	Mares	"	" " "
CATTLE:—				
4 bulls.—No particulars ...	No particulars	Bulls	"	Cook & Gamber, Molteno (20/11/12).
SHEEP:—				
93 rams	American Merinos.—Recorded by Ohio, Vermont, and New York Sheep Breeders' Associations	Rams	U.S.A.	" "
37 ewes	American Merinos.—Recorded by Ohio, Vermont, and New York Sheep Breeders' Associations	Ewes	"	" "

South African Produce Markets.

CAPETOWN.

The Produce Department of the firm of R. Müller, Capetown, reports under date of the 28th December, 1912, as follows :—

Ostrich Feathers.—Since issuing my last report, the London December sales took place. The attendance was not as good as u. ual, and the competition proved slow. In consequence thereof, several lots had to be withdrawn, the bids not coming up to expectation. In all, 115,000 lb. of feathers were offered for sale. Wing feathers receded fully 10 % (ten per cent.); spadonas, drabs, and floss suffered an almost similar decline. However, prices for boos (medium and short), blacks (medium and short), and drabs remained unchanged.

The London auction sales for 1913 have been fixed upon the following dates, viz.:—3rd February, 31st March, 2nd June, 28th July, 6th October, 1st December.

The sales of ostrich feathers in the Capetown market were but moderate in quantity, but the prices which were realized in this market cannot but be considered exceedingly good, bearing in mind the results at the London sales.

In the ordinary way, feathers were sold at the Capetown auction sales, and also out of hand.

The following prices speak for themselves :—

	£	s.	d.		£	s.	d.
Primes	16	0	0	to	30	0	0
First	11	10	0	„	16	10	0
Second whites	7	0	0	„	10	10	0
Third whites	2	5	0	„	5	10	0
Inferior and stalky whites	0	12	6	„	2	10	0
Byocks and fancy	2	0	0	„	10	0	0
Superior feminas	10	0	0	„	16	10	0
First feminas	7	10	0	„	9	10	0
Second feminas	3	0	0	„	7	0	0
Third feminas	1	0	0	„	2	10	0
Greys	2	0	0	„	9	0	0
White boos	1	0	0	„	3	0	0
Light boos	0	15	0	„	1	15	0
Dark boos	0	3	0	„	0	15	0
Inferior boos and tipless	0	1	0	„	0	10	0

	£	s.	d.		£	s.	d.
Long blacks	2	10	0	to	5	0	0
Medium blacks	1	10	0	„	3	0	0
Short blacks	0	2	6	„	1	5	0
Long floss blacks	1	5	0	„	2	10	0
Medium floss blacks	0	12	6	„	1	2	6
Short floss blacks	0	5	0	„	0	10	0
Long drabs	1	10	0	„	3	10	0
Medium drabs	0	7	6	„	1	5	0
Short drabs	0	2	6	„	0	7	6
Long floss drabs	1	7	6	„	2	0	0
Medium floss drabs	0	12	6	„	1	0	0
Short floss drabs	0	5	0	„	0	12	6
Inferior long blacks and drabs	0	10	0	„	1	15	0
Common blacks and drabs	0	1	0	„	0	5	0
Spadonas	0	5	0	„	2	10	0

Wool.—The last London wool sales closed on the 7th December. 99,000 bales were sold, whereof 2800 bales consisted of South African growth. There was a very large attendance, and the tendency was very firm, competition animated. Australian and New Zealand merinos and cross-breds showed an advance of ½d. to 1d. South African wools were easily competed for. Super snow whites advanced ½d. to 1d. Snow whites medium and inferior rose by 1d. to 1½d.; light grease combing wools showed an advance of ¾d.; heavy grease combing advanced by ½d.

Moderate quantities of wool were sold partly by auction sale and partly out of hand in the Capetown market, and the following prices have been paid :—

	d.		d.
Calvinia, long	6¼	to	7
Calvinia, medium	6	„	6½
Karroo and Roggeveld	6	„	9⅞
Short burry wools, heavy	4	„	4¾
Short burry wools, light	4¾	to	5½
C. and C., best grease	4¾	„	5¾
C. and C., medium	3½	„	4⅜
C. and C., inferior	1	„	3

Skins.—At the London auction sales, held towards the end of November, 126,000 goatskins were offered and 88,000 sold. The attendance and also competition was good. Medium weights were in good demand at ¼d. advance, light and extra light weights advanced up to ½d.; kids sold at par to ¼d. advance; dry damaged realized ½d. to ¾d. more than before. The competition proved very keen, in particular for Cape best heavies. As

will be seen from the following prices, the Capetown market is very strong. The prices which are being realized are decidedly in favour of sellers.

Goatskins, light	14d. per lb.	Pelts and damaged	4½d. per lb.
Goatskins, heavy	12d. per lb.	Caledon	7¾d. per lb.
Sundried and kids	8d. per lb.	Bastards	6½d. per lb.
Angoras	7d. per lb.	Capes, large	3s. 5d. each.
Angoras, bastard	10d. per lb.	Capes, medium	2s. 6d. each.
Angoras, shorn	6d. per lb.	Capes, cut	1s. 6d. each.
Longwools, Karroo	7d. per lb.	Capes, damaged and lambs	9d. each.
Short-wools	5½d. per lb.		

Hides.—The market for hides remains very firm. 9½d. is being paid for sound hides. whilst damaged hides fetch from 6d. to 8d. per lb.

PORT ELIZABETH.

Messrs. John Daverin & Co. report as follows, under date 21st December:—

Ostrich Feathers.—On account of Monday being a holiday, only two days' sale was held this week, when a fair average assortment was put forward. Competition was active for practically all descriptions, and prices were well maintained up to the close of the market on Wednesday afternoon, in some cases ruling decidedly in favour of sellers.

The market has now closed down until the 6th January, when, if we are to judge by the activity of the market at the close, we hope that present prices will be firmly maintained.

The total quantity sold on our market this week amounted to £16,458. 16s. 11d., and weighed 7075 lb. 5 oz.

We quote the following as current prices for:—

	£	s.	d.		£	s.	d.
Primes:							
Extra super	20	0	0	to	30	0	0
Good	12	10	0	„	17	10	0
Whites:							
Good to super	8	10	0	„	11	0	0
Good average	7	0	0	„	8	0	0
Average	5	10	0	„	6	10	0
Common and narrow	3	10	0	„	4	10	0
Good broken	6	10	0	„	9	0	0
Thirds	1	15	0	„	3	0	0
Fancies:							
Good	5	5	0	„	6	10	0
Ordinary	4	0	0	„	5	0	0
Feminas:							
Super	8	10	0	„	12	10	0
Good average	5	10	0	„	7	10	0
Average	3	15	0	„	5	0	0
Common and narrow	1	10	0	„	3	0	0
Good broken	4	10	0	„	6	15	0
Thirds	1	5	0	„	2	10	0
Greys:							
Good	4	10	0	to	6	10	0
Ordinary	2	10	0	„	3	15	0
Tails:							
Male, good, big, bold	2	5	0	„	3	10	0
Male, good average	1	15	0	„	2	0	0
Short and narrow	0	12	6	„	1	5	0
Female, light, good, big, bold	1	15	0	„	2	10	0
Female, light, good average	1	5	0	„	1	10	0
Female, light, short and narrow	0	7	6	„	0	12	6
Tails (contd.):							
Female, dark, good, big, bold	0	15	0	to	1	2	6
Female, dark, good average	0	10	0	„	0	12	6
Female, dark, short and narrow	0	5	0	„	0	7	6
Blacks:							
Long (special)	4	10	0	„	6	0	0
Long, good	2	15	0	„	3	10	0
Long, fair	1	15	0	„	2	10	0
Long, drabby	1	5	0	„	2	10	0
Medium	1	5	0	„	2	0	0
Short	0	7	6	„	0	17	6
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Drabs:							
Long, special	2	10	0	„	4	0	0
Long, good	1	10	0	„	2	5	0
Long, fair	1	0	0	„	1	7	6
Medium	0	15	0	„	1	10	0
Short	0	4	0	„	0	12	6
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Spadonas:							
Light (special)	3	0	0	„	5	0	0
Light, fair to good	1	15	0	„	2	10	0
Light, narrow	0	10	0	„	1	5	0
Dark	1	0	0	„	2	5	0
Chicks	0	1	6	„	0	5	0

The following may be quoted as the approximate current values of unsorted parcels per line:—

	Whites. £ s. d.		£ s. d.	*Feminas.* £ s. d.		£ s. d.
Superior pluckings	8 0 0	to	10 0 0	6 0 0	to	8 10 0
Good average lots	6 0 0	„	7 0 0	4 0 0	„	5 0 0
Poor average lots	4 10 0	„	5 10 0	3 0 0	„	3 10 0
Common lots, stalky, narrow, and discoloured	3 10 0	„	4 10 0	2 0 0	„	2 15 0

	Tails. s. d.		s. d.	*Blacks.* s. d.		s. d.	*Drabs.* s. d.		s. d.	*Spadonas.* s. d.		s. d.
Good	20 0	to	30 0	20 0	to	45 0	15 0	to	25 0	30 0	to	55 0
Average	12 6	„	17 6	12 6	„	15 0	8 6	„	12 6	25 0	„	30 0
Poor	7 6	„	10 0	8 0	„	11 0	5 0	„	7 6	10 0	„	20 0

It will be understood that for special lots these quotations may be exceeded.

Wool.—In our report last week we referred to the less active demand that existed in the market, and this has continued during the week, and at the catalogue sales on Wednesday, when 2579 bales were offered, of which only 575 bales were sold, this weakness was more pronounced.

The general feeling is that this is attributable to the close of the year and the near approach of the holidays, and that after the New Year we will doubtless have similar activity in the demand at prices on a par with those hitherto current here.

We notice the public cable on Friday mentioned that in Melbourne the sales there showed an improvement of 10 per cent. on the opening prices, and our information from England points to a continuance of the present soundness in the wool market generally.

This year is ending with very low stocks held here, and this fact also will tend, we trust, to a strong market after the turn of the year.

On the public market on Thursday 636 bales were offered, of which 415 bales were sold.

The biddings and prices there were about on a par with those for similar wools offered at the previous day's catalogue sale.

We quote the following as current prices :—

	d.		d.
Snow white extra superior	None offering		
„ superior	20	„	21
„ good to superior	17	„	18
„ inferior faulty	14	„	16
Grease, super choice clips	10¾	„	11½
Grease, super long, well-conditioned, grassveld grown (special clips)	10	„	10¾
Grease, super long, grassveld grown	8½	„	9
Grease, super long, Karroo grown (special clips)	8¾	„	9½
Grease, super long, Karroo grown	8	„	8½
Grease, super long, mixed veld	7½	„	8¼
Grease, light, faultless, medium, grassveld grown	7½	„	8¼
Grease, light, faultless, medium, Karroo grown	7	„	7¾
Grease, light, faultless, short, Karroo grown	6	„	6¾
Light Karroo lambs	7	to	8¼
Cross-bred grease	6¼	„	7¾
Cross-bred scoured	12	„	14
Grease, coarse and coloured	4¾	„	6
Scoured, coarse and coloured	8	„	13
Basuto grease, short	6½	„	7
O.F.S. grassveld grease, long and well-conditioned (special clips)	8	„	8½
O.F.S. grassveld grease, long and well-conditioned	7¼	„	7¾
O.F.S. grassveld grease, medium grown, light, with little fault	6½	„	7
O.F.S. grassveld grease, short, faulty, and wasty	5½	„	6
O.F.S. Karroo grown, long and well-conditioned	7¼	„	7¾
O.F.S. medium grown, light, with little fault	6½	„	7
O.F.S. short, faulty, and wasty	5	„	5¾

Mohair.—There is absolutely nothing doing in this market at the moment. Buyers inform us that they are in cable communication with their principals on the other side with a view of receiving instructions to buy. Should any buying orders come before the turn of the year the limited stock held here will no doubt be placed to advantage.

There is absolutely nothing new to report this week.

On the public market on Tuesday 44 bales were offered, and 30 bales sold.

The following are current values :—

	d.		d.
Super summer kids	None offering		
Ordinary kids and stained	„		„
Very mixed and stained	„		„
Superior Klips (special clips)	„		„
Ordinary firsts	None offering		
Short firsts and stained	„		„
Superfine long blue O.F.S. hair	11½		12
Mixed O.F.S. mohair (average)	10	to	10¼

	d.		d.		d.		d.
Mixed O.F.S. mohair, very mixed	8½	to	9½	Winter kids, good ordinary......	12½	to	13½
Seconds and grey..............	6	„	7½	Winter mohair................	9	„	9¼
Thirds.....................	4½	„	5	Basuto mohair................	9½	„	10½
Winter kids, special clips (nominal)	14½	„	14¾	Basuto mohair, grey	5½	„	7

Skins.—Sheepskins, 7½d. per lb.; damaged, 6½d. per lb. Pelts, 4¾d. per lb.; damaged' 3½d. per lb. Hair Capes, 3s. 2d. each; sundried, 2s. each; cut, 1s. each; damaged, 7d. each. Coarse wools, 6d. per lb. Goat, 13¾d. per lb.; heavy, 11d. per lb.; sundried, 11d. per lb.; damaged, 7½d. per lb. Bastards, 11d. per lb.; damaged, 5d. per lb. Angora, 8½d. per lb.; sundried and heavy, 7¾d. per lb.; shorn, 6½d. per lb.; damaged, 3¾d. per lb. Springbok, 9d. each. Johannesburg sheep, 5½d.; damaged sheep, 3d. Pelts, 2½d. Goat, 10½d.; damaged, 5½d. Angora, 6¾d.; damaged, 2½d. per lb.

Hides.—Sundried, 13½d.; damaged, 12½d.; salted, 12½d.; damaged, 11½d. per lb.

Horns.—3½d. each all round.

EAST LONDON.

The Produce Department of Messrs. Malcomess & Co., Ltd., report as follows, under date 31st December:—

Wool.—Since our last, dated 29th ult, was written, the chief item of interest was the closing of the London colonial wool sales, when values were reported as follows:—

Superior long combing wools	7½% above last sales.
Heavy combing wools	5 to 7½% above last sales.
Snow whites	7½% above last sales.
Short grease	par to 5 % above last sales.

This was reflected on the local market, and good business was done at full prices up to the last sale of the year which was held on the 19th. Since then the market has been quieter, partly owing to the holidays, but also due to the fact that prices in Bradford are somewhat easier. Moreover, buyers are neglecting the very heavy types of wools, and these are a drag on the market at present. Up-country holders of such wools will do well to remember that stocks of heavy long wools are still on the increase, that buyers are *not* keen on them. Moreover, though the market may be a bit higher than twelve months ago, the drought has made wools much heavier this year—which more than counterbalances the higher level. Unless some are prepared to accept the current market rates, we fear their wools will remain unsold.

Transactions for the month total:—

Sale, 4th December,	5,700 offered,	3,500 sold—sales for week,	6,000 bales
„ 11th „	4,500 „	3,000 „ „ „	5,000 „
„ 19th „	4,500 „	3,300 „ „ „	5,000 „
Since 19th December	—	— „ „ „	1,500 „
	14,700	10,000	Sales for month, 17,500 bales

which is a fair clearance.

It may also be mentioned that the shipments from the Port of East London of wool total the large quantity of 208,000 bales during 1912, as compared with 174,000 bales during 1911, or an increase of 34,000 bales, which is very satisfactory.

	d.		d.		d.		d.
Transkeis: practically nothing more available				Super long well-conditioned grassveld	6½	to	9½
Basuto, good to average	6½	„	6¾	Short faulty grease.............	4½	„	5½
Super short Kaffrarian farmers' .	8	„	10	Long „ „	5¼	„	7½
Super long Kaffrarian farmers'..	8	„	11½	C. and C. grease (good average)..	4¾	„	5¾
Super short well-conditioned grassveld	6	„	7¾	„ „ (very kempy)...	2	„	3

Mohair.—There is no change to report in this market.

	d.		d.		d.		d.
Best sorted silky full 12 months grown, blue, free of kemp.....	11½			Sortings according to quality and length	5½	to	7½
Good long silky full 12 months grown, slightly kempy........	10	to	11	Coloured hair.................	5		
Good to best sorted Basuto mohair, up to	10			Good winter hair..............	8½	„	9
Average Basuto mohair.........	8½	„	9	Average winter hair............	7½	„	8
				Super genuine winter kids......	12	„	13½

Sundry Produce.—There has been very considerable weakness in this, especially in the Hides market. News from Home reported considerable drops in the sales there, and buyers now refuse to make any definite offers. It is hardly likely that the extreme prices of last few weeks will again be reached and we can only give a nominal valuation for hides. Sun-dried hides, nominal, 12½d. Dry-salted hides, nominal, 11½d. Goat skins, 13d. Angora skins, 8d. to 9d. Angora skins (Transkeian), 9d. to 10d. Sheepskins, for super first quality parcels, 7d.; for C. and C. skins, 5d. to 5¼d.; for pelts, 4½d.; for Transkeis, 4¾d. Horns, according to size and quality.

DURBAN.

Messrs. Reid and Acutt's Wool Mart, Ltd., Esplanade, Durban, report as follows under date 30th December, 1912:—

The extremely high prices mentioned in our last report, dated 30th November, have not been maintained during the month just closed.

On our sale of 6th inst. there was noticeable a distinct tendency to limit prices, and as the month went on each week's auction showed a weaker tone, the result being that prices all round declined considerably, particularly for heavy-conditioned wools. This decline is largely due to the fact that the milling results of shipments made earlier in the season have proved most disappointing, and on top of this the majority of the wools now reaching market are showing in very heavy condition, doubtless due to the long drought experienced in many parts of the country.

The next series of London auctions opens there on 14th January, 1913, and until these have been in operation for a day or two it is difficult to state exactly how values are likely to trend. It is not anticipated, however, that any improvement will be registered, and we are afraid that heavy-conditioned and short wools will continue dull and difficult of sale, and that values for these may tend to go still lower.

In spite of the generally duller market competition our sales continue brisk, especially for well-grown, light conditioned wools, which are still saleable at very excellent prices. During the month we have, as usual, been favoured with numerous well-got-up sorted farmers' clips, and these have in every instance been disposed of at prices most satisfactory to the growers, some of the figures being as follows:—

Messrs. A. & V. Robertson, Amersfoort, Transvaal.

40 bales	Ewes'	12¼d. per lb.
31 „	Lambs'	11¼d. „
17 „	Wethers'	11¼d. „
16 „	Ewes'	8⅞d. „
7 „	Hoggetts'	8¾d. „
6 „	Ewes'	7½d. „
4 „	Hoggetts'	8⅛d. „
5 „	Rams'	7⅝d. „
9 „	Bellies	8d. „
8 „	1st Pieces	8d. „
11 „	2nd „	7¼d. „
8 „	Locks	5¾d. „

Messrs. Robertson Bros., Amersfoort, Transvaal.

62 bales	Ewes' and Wethers	10½d. per lb.
23 „	Hoggetts'	10⅛d. „
1 „	Fleeces	9d. „
14 „	Bellies and Pieces	7¼d. „
3 „	7 mos. Lambs'	6¼d. „
2 „	2nd Pieces	5½d. „
3 „	Locks	4d. „

E. C. Long-Innes, Esq., Amersfoort, Transvaal.

Wethers' Fleeces	10⅝d. per lb.
Hoggetts' „	10¼d. „
Ewes' „	9⅜d. „

P. Fick, Esq., Amersfoort, Transvaal.

Ewes' Fleeces	10⅝d. per lb.

H. P. Maree, Esq., Senekal, O.F.S.

31 bales Fleeces	9⅞d. per lb.

J. S. Thompson, Esq., Senekal, O.F.S.

Hoggetts' Fleeces ...	... ...	10⅞d. per lb.
Ewes' and Wethers'	... ...	9⅞d. „

Mohair.—The demand for this article shows practically no change, but competition continues fairly brisk.

Coarse and Coloured.—This is still in very keen demand, extremely high prices being realized.

Current Market Rates of Agricultural Produce and Stock.

The following TABLE OF CURRENT MARKET RATES OF AGRICULTURAL PRODUCE AND LIVE STOCK on Saturday, 28th December, 1912, ruling at the several Centres named, is published for general information.

Centre.	A. Wheat per 100 lb.	B. Wheat Flour per 100 lb.	C. Boer Meal per 100 lb.	D. Mealies per 100 lb.	E. Mealie Meal per 100 lb.	F. Barley per 100 lb.	G. Oats per 100 lb.	H. Oat-hay per 100 lb.	J. Lucerne Hay per 100 lb.	K. Potatoes per 100 lb.	L. Tobacco (Boer Roll) per lb.	M. Beef per lb.	N. Mutton per lb.	O. Fresh Butter per lb.	P. Eggs per dozen.	Q. Cattle (Slaughter).	R. Sheep (Slaughter).	S. Pigs.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	s. d.	£ s. d.
Cape Province:																		
Aliwal North ...	12 6	23 6	30 0	20 0	22 6	15 0	16 6	7 6	6 0	20 0	1 0	0 10	0 8	2 3	1 6	12 10 0	*20 0	†2 15 0
Beaufort West ...	12 6	17 9	13 6	10 6	10 6	9 0	8 3	4 6	5 0	14 0	1 0	0 6	0 5	1 9	1 6	13 0 0	13 0	5 0 0
Capetown ...	—	—	—	9 0	—	8 0	6 4	4 8	6 0	12 0	0 7‡	—	—	1 6	1 9	—	—	—
East London ...	9 6	18 6	30 0	6 6	13 6	5 0	6 0	5 6	5 0	20 0	1 0	0 4	0 5	2 3	2 0	15 0 0	20 0	1 10 0
Grahamstown ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kimberley ...	12 0	17 6	15 0	9 0	10 6	7 0	7 6	5 3	5 6	17 6	0 5	0 7	0 6	2 0	2 0	14 0 0	15 0	3½d. p. lb.
Kingwilliamstown	10 0	18 9	16 6	10 6	11 6	10 0	9 0	7 3	4 9	19 0	1 3	0 9	0 9	1 9	1 3	12 0 0	25 0	3d. p. lb.
Port Elizabeth ...	10 6	—	—	10 0	—	—	8 0	5 0	—	14 0	—	0 6	0 6	2 6	2 0	—	—	2 10 0
Queenstown ...	12 6	17 6	16 0	10 6	12 6	10 0	10 0	7 0	6 0	14 6	0 9	0 6	0 4	2 6	1 6	—	—	—
Natal:																		
Durban ...	—	—	—	9 6	—	—	—	—	4 6	16 0	—	—	0 6	1 6	1 7	—	—	—
Pietermaritzburg	10 10	—	—	10 6	—	12 6	8 0	5 6	5 0	14 0	0 4	0 6	0 6½	1 3	1 5	—	—	—
Transvaal:																		
Pretoria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Johannesburg ...	11 6	—	12 9	9 0	7 6	9 0	8 3	6 9	5 9	16 8	0 4	—	—	1 4	1 4	—	—	—
Orange Free State:																		
Bloemfontein ...	—	—	32 6	9 0	—	—	9 0	7 9	5 6	18 0	0 6	0 10	0 8	2 6	1 9	—	—	—
Harrismith ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Average, 15s. to 25s. † Average, £2. 10s. to £3. ‡ Average, 4d. to 10d.

Outbreaks of Animal Diseases.

THE following outbreaks of scheduled infectious and contagious animal diseases have occurred in the areas specified during the month ended 31st December, 1912.

C. E. GRAY,
Principal Veterinary Surgeon (Union).

CAPE PROVINCE PROPER.

(EXCLUDING TRANSKEIAN TERRITORIES.)

Anthrax.

District.	Area.	Number of Deaths.	Number of Contacts.
Albany	Salem Commonage	1	Unknown
Taungs	Taungs Location	1	107
Taungs	Mokassa	1	1
Komgha	Lot 16/xiii/37	2	41
"	Lot 4/xiii/4, 5, and 8	1	36
Uitenhage	Perseverance	1	Unknown

East Coast Fever.

District.	Area.	Number of Animals Sick.	Number of Animals Dead.	Number of Animals in contact.
East London ...	Lot 6, Lilyfontein, Ward 7	Nil	3	Unknown at present
Kingwilliamstown ...	Npantiso's Location ...	1	2	Unknown at present

Epizootic Lymphangitis.

District.	Area.	Number affected.	Number of contacts.
East London ...	East London	1	Nil

Glanders.

District.	Area.	Number of Animals Destroyed. Clinically Affected.	Number of Animals Destroyed. Reacted to Mallein Test.	Number of Contacts Tested.
Cape	Capetown	1	Nil	5
Komgha	C.M.R. Camp	Nil	1	9
Port Elizabeth ...	Port Elizabeth	Nil	1	2

TRANSKEIAN TERRITORIES.

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Tsolo	Sigonyila's Location	98	450
"	Mfundisi's Location	—	—
Mount Ayliff	Mzukula's Location	2	49
"	Saul's Location	1	6
Umtata	Edgerton	2	140
"	Lyndale	2	100
"	Somerset	–	25
"	Devon	—	25

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Kentani	Nzanda's Location	—	—
Nqamakwe	Mavuso's "	—	—
Umtata	Kedgesville	-	—

Glanders.

District.	Name of Farm.	Clinically Affected and Destroyed.	Reacted to Test and Destroyed.	Number of In-contacts Tested.
Tsolo	Tsolo Village	6	—	5

Mange in Equines.

District.	Name of Farm.	Number of Animals Affected.	Number of In-contacts.
Umtata	Umtata Township	1	—
Idutywa	Idutywa Village	4	30

NATAL.

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Alexandra Division	Mbeyana...	6	7
" "	Ghornberry	7	31
Bergville "	Bester's Hoek	1	19
" "	Whitestones	—	—
Lions River "	Ellesdene	-	—
Underberg "	F. P. 111	—	—
" "	The Ridge	—	—
" "	Halley	—	—
" "	F. P. 17	—	—
" "	F. P. 18	—	—
" "	Windy Gap	—	—
Paulpietersburg Division ...	Paadafontein	4	45
Pietermaritzburg Division ...	Town Lands	2	95
Umvoti Division	Redclyffe	1	261

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Polela Division	Deepdale...	1	—
Umvoti Division	Wonderboom	1	40

Epizootic Lymphangitis.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Lower Tugela Division ...	Chaka's Kraal	1	7

Glanders.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Durban	Durban Borough	Two clinically affected and destroyed	Nil

Tuberculosis.

District.	Name of Farm.	Number of Animals Tested.	Number of Reactions and Destroyed.	Number of Doubtful Reactions to be Retested.
Pietermaritzburg	11 Berg Street	11	1	—
"	College Road	3	1	—
"	Town Hill	13	1	—
Polela Division ...	Inglenook	1	1	—

TRANSVAAL.

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Rustenburg	Reitfontein No. 911	5	300
Witwatersrand	Klippoortje No. 13	3	—

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Barberton	Worcester Gold Mine ...	—	100
"	Tokenhouse Farm	1	16

ORANGE FREE STATE.

Glanders.

District.	Name of Farm.	Clinically Affected and Destroyed.	Reacted to Test and Destroyed.	Number of In-contacts Tested.
Bethulie	Donkerpoort	—	2	4
Lindley	Erf 155, Lindley Town ...	1	—	1

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Kroonstad	Kaalfontein	5	—
Senekal	Malpha	5	56

Scabies (Equine).

District.	Area.	Number of Animals Affected.	Number of Contacts.
Alexandria	Village	1	Nil

Tuberculosis.

District.	Area.	Number of Animals Tested.	Number of Reactions to Test and Destroyed.	Number of Doubtful Reactions to be Retested.
Cape	Various	131	6	1
Malmesbury ...	"	31	Nil	Nil
Paarl	"	38	"	"
Stellenbosch ...	"	37	"	"

Farm Employment.

Englishman, aged 60, with farming experience in England and eighteen years' experience in South Africa, desires employment on farm in capacity of manager or otherwise. Is thoroughly acquainted with and proficient in dairying and stock farming and the raising of crops of all kinds. Thoroughly understands the working of lands, pruning, laying out of farms, etc. Is in addition a first-class accountant. Terms to be arranged.—J. H. V. MICHELL, 118 Bree Street, Capetown. [11]

Several young men, accustomed to farm work, seek engagement as managers, assistants, or learners of South African farming with progressive farmers. For particulars apply to F. T. NICHOLSON, Box 134, Pretoria. [11]

Applicant, aged 28, is anxious to obtain employment on a farm at terms to be arranged. Has spent most of his life in farming in this country, and is specially interested in farm machinery and the manipulation thereof, of which he has a good knowledge. Married. Dutch-speaking, and possesses a slight knowledge of English.—G. L. EHLERS, Berg Rivier Mond, via Vredehoek, Malmesbury. [12]

Employment is desired by manager, 39, on tobacco or fruit farm. Experienced in tobacco growing and general farming.—C. A. FAIRLIE, 46 Esselen Street, Johannesburg. [12]

Management of farm wanted by thoroughly experienced young man. Thorough knowledge of ostriches and lucerne growing.—C. SCHEEPERS, Post Restante, Jeppe. [12]

A healthy, steady young man of 22 years of age, unmarried, desires situation on a farm. Born in South Africa. Thoroughly acquainted with general farming business. Not afraid to do work of any kind on a farm.—H. R. WATKINS, Smalpoort, P.O. Ida, Elliot, C.P. [1]

Applicant, 21 years of age, with knowledge of simple book-keeping, desires employment on a farm. No experience of South African farming, but is willing to learn.—ALEXANDER SIDDENS, P.O. Box 691, Capetown. [1]

Employment on farm is sought by a young German, 26 years of age. Married (but wife would not accompany him on farm). Has had good experience of farming, and horse and cattle breeding. Three years on intensive farms in Germany as manager, and can show good testimonials. Good education. Speaks English and Dutch.—FRITZ BAUM, Friederichsruh, P.O. Ida, via Indwe, C.P. [1]

Applicant, age 29, single, steady, desires to obtain situation on farm anywhere in the Union of South Africa. Accustomed to working with horses and oxen; understands all kinds of farming—agricultural and stock—and all up-to-date dairy work, calf rearing and feeding. Has had nine years' experience in South Africa.—H. H. WILLEY, South Coast Junction, Durban, Natal. [1]

Young man of good education, age 17, desires position on farm as learner. Natal Province preferred.—H. A. F., Box 274, Maritzburg, Natal. [1]

Agricultural Show Dates, 1913.

Secretaries of Societies which propose holding shows during 1913, the dates of which do not appear in the following list, are invited to send particulars at the earliest opportunity.

CAPE PROVINCE.

Paarl, 30th January.
Robertson, 4th and 5th February.
Stellenbosch, 6th February.
Worcester, 11th and 12th February.
Britstown, 18th February.
Caledon, 18th and 19th February.
Queenstown, 19th and 20th February.
Ceres, 20th February.
Beaufort West, 20th and 21st February.
Malmesbury, 21st February.
Rosebank, 25th to 28th February.
Cathcart, 26th February.
Graaff-Reinet, 4th and 5th March.
Middelburg, 6th to 8th March.
Cradock, 11th and 12th March.
Bathurst, 12th and 13th March.
Molteno, 12th and 13th March.
Oudtshoorn, 12th and 13th March.
Somerset East, 14th and 15th March.
Aliwal North, 14th and 15th March.
Barkly East, 19th and 20th March.
Humansdorp, 19th and 20th March.
Grahamstown, 26th and 27th March.
Port Elizabeth, 1st to 4th April.
Kimberley, 8th to 10th April.

TRANSVAAL.

Bronkhorstspruit, 12th February.
Amersfoort, 26th and 27th February.
Ermelo, 29th February.
Bethal, 5th March.
Middelburg, 7th March.
Leslie, 10th (?) March.
Volksrust, 12th and 13th March.
Carolina, 19th March.
Standerton, 19th and 20th March.
Wakkerstroom, 20th March.
Johannesburg, 26th to 29th March.
Potchefstroom, 16th and 17th April.
Klerksdorp, 14th May.
Pretoria, 22nd to 24th May.
Rustenburg, 30th and 31st May.
Waterberg, 20th May.
Wolmaransstad, 4th and 5th June.
Barberton, 4th July.

NATAL.

Vryheid, 6th and 7th June.
Umvoti, 20th and 21st June.
Alexandra, 24th June.
Pietermaritzburg, 25th to 27th June.
Durban, 2nd to 4th July (provisional dates).
New Hanover, 10th July.
Richmond, 25th July.

ORANGE FREE STATE.

Kroonstad, 26th and 27th February.
Marquard and Clocolan, 26th and 27th February.
Rouxville, 26th and 27th February.
Ficksburg, 4th and 5th March.
Lindley, 4th and 5th March.
Thaba 'Nchu, 4th and 5th March.
Bethulie, 5th and 6th March.
Jagersfontein, 11th and 12th March.
Senekal, 11th and 12th March.
Vrede, 12th and 13th March.
Wepener, 12th and 13th March.
Fauresmith, 18th and 19th March.
Boshoff, 19th and 20th March.
Smithfield, 18th and 19th March.
Bethlehem, 19th and 20th March.
Edenburg, 25th and 26th March.
Hoopstad, 26th and 27th March.
Harrismith, 1st and 2nd April.
Heilbron, 2nd and 3rd April.
Winburg, 9th and 10th April.
Bloemfontein, 15th to 17th April.
Ladybrand.--No show will be held, owing to drought.

Departmental Notices.

TOBACCO SEED.

The Tobacco and Cotton Division will have a quantity of selected and acclimatized tobacco seed of heavy and bright types for distribution about June, 1913. All applications for seed must reach the Chief of the Tobacco and Cotton Division, P.O. Box 516, Pretoria, not later than 1st May, 1913.

This seed will be distributed pro ratio at a charge of 1s. per oz. Each applicant will be informed soon after the 1st May what quantity can be supplied and the seed will be dispatched so soon as the cash is remitted.

Turkish Tobacco Seed: The following varieties of Turkish seed can be obtained from the Officer in Charge of Turkish Tobacco Experiments, La Motte, Paarl, Cape Province, at the prices quoted, viz.:—

Soulook	4s. per oz.
Malcadje	4s. „
Baladovari	4s. „
Dubeck	5s. „

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

CLEANING AND GRADING TOBACCO SEED.

The Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, are prepared to clean and grade tobacco seed sent to them by farmers free of charge.

The process separates the light from the heavy seed, and the result is that a much larger percentage of the cleaned seed will germinate.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

COTTON SEED.

Selected seed of several varieties of American Upland Cotton can be obtained from the Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, at a charge of 3d. per lb.

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

VETERINARY RESEARCH LABORATORY, ONDERSTEPOORT.

Admission of Visitors.

It is hereby notified for the information of the public that visitors cannot be admitted to the Veterinary Research Laboratory at Onderstepoort during working hours on weekdays unless a special permit has previously been obtained from the Secretary for Agriculture.

The most convenient time for visitors to be shown over the Laboratory is Sunday afternoon, when an officer will be specially detailed for the purpose and permits will not be required.

ORGANIZATION OF DEPARTMENT OF AGRICULTURE.

Administrative Office ... ... Pretoria.
Telegraph Address ... ... "Landbouw, Pretoria."

Secretary for Agriculture: F. B. Smith. Under-Secretaries for Agriculture: P. J. du Toit and A. Holm. Deputy-Accounting Officer: J. Collie. Chief Clerk: G. N. Williams. Officer in Charge of Inquiry Office, Capetown: G. W. Klerck.

VETERINARY DIVISION.

This Division endeavours to prevent the introduction of contagious diseases of live stock into the Union and to eradicate such as are already present, and to protect live stock against enzootic diseases by inoculation and other means. So far as it is able to do so without interfering with its other duties, the Division advises and assists farmers upon diseases of stock generally and endeavours to enlighten them upon veterinary hygiene and the care of live stock. For veterinary purposes the Union is divided into five areas, each in charge of Senior Veterinary Officers, who are responsible for the control of disease within these areas.

Principal Veterinary Officer: C. E. Gray. Assistant Principal Veterinary Officer: J. D. Borthwick.

Cape Province.—Senior Veterinary Officer: R. W. Dixon, Government Offices, Parliament Street, Capetown. Government Veterinary Officers: C. S. Elphick, Vryburg; E. Fern, Capetown; A. Matthews, Capetown: G. W. Freer, Uitenhage; R. I Jones, East London; J. H L. Lyons, East London; J. Nichol, Kingwilliamstown; W. G. Pakeman, Queenstown; and W. A. Simson, Cradock.

Transvaal.—Senior Veterinary Officer. J. M. Christy, Department of Agriculture, Pretoria. Government Veterinary Officers: R. S. Garraway, Pretoria; W. G. Evans, Volksrust; P. Conacher, Johannesburg; J. G. Bush, Krugersdorp; T. H. Dale, Potchefstroom; H. M. Webb, Zeerust; J. M. Tate, Rustenburg; J. Chalmers, Nylstroom; J. I. Edgar, Pietersburg; G. Lee, Lydenburg; G. C. Webster, Barberton; D. B. J. McCall, Ermelo; and G. May, Standerton.

Natal.—Senior Veterinary Surgeon: W. M. Power, Colonial Buildings, Pietermaritzburg. Government Veterinary Surgeons: S. H. Ewing, Eshowe: A. F. Harber, Point, Durban; S. I. Johnston, Maritzburg; F. J. Hill, Bulwer; A. Goule, Maritzburg; J. L. Webb, Mooi River; C. Tyler, Ladysmith; and F. Hutchinson, Dundee.

Orange Free State.—Senior Veterinary Surgeon: A. Grist, Government Buildings, Bloemfontein. Government Veterinary Surgeons: J. F. Joyce, Ficksburg; J. A. A. Hamilton, Kroonstad; F. M. Skues, Beth'e em; C. H. Wadlow, Smithfield; and C. T. Clemow, Frankfort.

Transkeian Territories.—Senior Veterinary Officer: J. Spreull, Umtata. Government Veterinary Surgeons: A. C. Kirkpatrick, A. M. Howie, T. M. Doyle, W. A. Dykins, A. Goodall, G. T. Henerson, and J. A. Worsley.

DIVISION OF VETERINARY RESEARCH.

The duty of this Division is the investigation of diseases of live stock with a view to discovering methods of eradicating them or of protecting animals against them. It examines and reports upon pathological specimens forwarded by the Veterinary Division and farmers and prepares vaccines and sera of various kinds, and also mallein, tuberculin, and other diagnostic and preventive agents.

Opportunities are offered to post-graduate students for the carrying out of specia investigations and a great deal of educational work is performed by the Division.

The Division is in close touch with and is complementary to the Veterinary Division. Director of Veterinary Research: Dr. A. Theiler. Assistant Director of Veterinary Research: W. Robertson. Superintendent: E. Parkes. Professional Assistants: D. T. Mitchell W. H. Andrews, D. Kehoe, F. Veglia, W. Jowett, G. N. Hall, G. A. H. Bedford, A. W. Shilston (Pietermaritzburg), and J. Walker (Grahamstown).

DIVISION OF SHEEP.

This office is charged with:—(*a*) Eradication of scab; (*b*) improvement of pastora industries; (*c*) the management of the Stud Sheep Farm at Ermelo; (*d*) the improvement of the flocks maintained on the various Experimental Farms; and (*e*) the control of the Field Cornets in the Transvaal Province.

Chief of Division: B. G. L. Enslin. Principal Sheep Inspector: A. G. Davison. Principal Sheep and Wool Expert: Charles Mallinson.

For the better carrying out of the work in connection with scab, the Union is divided into twenty-four areas in charge of Senior Sheep Inspectors; these areas are in turn divided into 297 inspection districts, each in charge of an Inspector. In addition there are ten

Inspectors employed on the railway lines for the prevention of the movement of infected stock by rail. There are also five whole-time Inspectors employed on certain large commonages.

A similar organization is adopted in respect of the improvement of sheep and wool.

Orange Free State Province.—Sheep and Wool Expert: J. F. McNab, Bloemfontein. Assistant Sheep and Wool Expert: A. V. M. Suter, Bloemfontein.

Cape Province.—Sheep and Wool Expert: W. M. McKee, Queenstown. Assistant Sheep and Wool Experts: E. V. Goddefroy, Worcester; P. S. Taylor, Steynsburg.

Transvaal Province.—Western District Assistant Sheep and Wool Expert: A. M. Spies, Headquarters not yet fixed. Eastern District Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal.

Natal Province.—Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal. This area includes the East Griqualand District of the Cape Province.

Manager, Ermelo Stud Sheep Farm: A. G. Michaelian.

DIVISION OF ENTOMOLOGY.

This Division obtains and disseminates information relative to beneficial and injurious "insects." In collaboration with the Division of Plant Pathology, it administers the law relating to the introduction of plants into the Union and by the inspection of nurseries and other methods, it endeavours to control injurious "insects" present in the Union; it is also responsible for the destruction of locusts.

Chief of Division: C. P. Lounsbury. Entomologists: Claude Fuller and C. P. v. d. Merwe, Pretoria; C. W. Malley, Capetown; .... Bloemfontein; and C. B. Hardenberg, New Hanover, Natal (investigating wattle insects).

DIVISION OF BOTANY.

This Division is concerned with the investigation of the merits of indigenous plants of economic importance and of poisonous plants and noxious weeds, the identification of plants, the introduction and testing of economic plants from abroad and the improvement of farm crops by breeding.

Chief of Division: J. Burtt-Davy. Herbarium Assistant: Miss C. Stent.

DIVISION OF PLANT PATHOLOGY AND MYCOLOGY.

This Division in engaged in the investigation and control of diseases of plants, produced by fungous and physiolog cal causes, and the stu ly and collection of fungi of economic importance.

Chief of Division: I. Pole Evans. Professional Assistants: Miss E. M. Doidge and P. v. d. Byl.

DIVISION OF TOBACCO AND COTTON.

The object of this Division is the promotion of the tobacco and cotton industries. Experiments are conducted in the breeding and growth of tobacco and cotton and in the curing, fermentation, and preparation of tobacco for the market. Approved varieties of tobacco and cotton seed are distributed amongst farmers and advice given to them personally and by correspondence and publications.

Chief of Division: W. M. Scherffius. Tobacco Warehouse Expert: T. E. Elgin. Expert for Turkish tobacco, Western Province, Cape; L. M. Stella, "La Motte," Paarl. Manager, Experiment Station, Rustenburg: H. W. Taylor. Manager, Experiment Station, Barberton: W. B. Wilson. Manager, Tzaneen Estate: E H. F. Powell. Manager, Experiment Station, Piet Retief: R. Falgate. Manager, Cotton Experiment Station, East London: D. D. Brown.

DIVISION OF DAIRYING.

This Division deals with all matters connected with the advancement of dairying. The Division also controls the Cold Stores at Vryburg.

Superintendent of Dairying: E. O. Challis. Senior Inspector: .... Instructors: *Cape Province.*—T. R. Carruthers, Government Offices, Parliament Street, Capetown, and C. Schmolke, Queenstown. *Orange Free State.*—W. Oosterlaak, Government Buildings, Bloemfontein. *Natal.*—............................, Colonial Office, Pietermaritzburg. *Transvaal.*—L. J. Veenstra, Department of Agriculture, Pretoria.

DIVISION OF HORTICULTURE.

This Division advises farmers on the growing and marketing of fruit, including table grapes and raisin drying, and grades fruit for export.

Chief of Division: R. A. Davis. Horticulturist in charge of Experiment Station, Warmbaths: C. A. Simmonds. Horticulturist in charge of Experiment Station, Ermelo: R. le Sueur. Instructor in Horticulture, Cape Province: S. W. van Niekerk, Bovenvallei, Wellington.

DIVISION OF VITICULTURE.

This Division is charged with the duty of advising farmers in all matters relating to the culture of the vine (excluding table grapes and raisin-making) and the manufacture of wine and brandy, and vinegar. It conducts field investigations into the suitability of various stocks, the use of fertilizers, modes of cultivation, etc., and investigates the diseases of the vine, and conducts both cellar and laboratory experiments in the making of wine and brandy. It examines pathological specimens and furnishes reports thereon, and examines chemically and bacteriologically specimens of the products above mentioned with a view to furnishing advice thereon to farmers.

This Division also includes the Government Wine Farm, Groot Constantia, where advice can be obtained by residents in the Wynberg and Hout Bay areas.

Government Viticulturist: A. J. Perold, Œnological Station, Paarl, Cape Province. Manager, Government Wine Farm, Groot Constantia: T. L. Watermeyer.

OFFICE OF GUANO ISLANDS.

This office undertakes the conservation, collection, shipment, and sale to the public of the guano, seal skins, etc., obtained on the various islands belonging to the Union, and is charged with the administration of all matters connected therewith.

Superintendent: W. R. R. Zeederberg, 69 Strand Street, Capetown.

DIVISION OF CO-OPERATION.

This Division is engaged in promoting co-operation for the sale and purchase of agricultural products and necessities amongst farmers and in organizing and supervising co-operative societies.

Superintendent: C. H. Keet. Chief Inspector: J. Retief. Assistant Inspectors: J. T. Taylor and H. Minnaar.

DIVISION OF CHEMISTRY.

This Division investigates problems of general or special importance, and for the present undertakes the analysis of soils, manures, and foodstuffs for farmers in the Transvaal, the analysis of similar matters in the other Provinces being undertaken in the laboratories of the Department of the Interior at Capetown, Grahamstown, Maritzburg, and Bloemfontein, pending the enlargement of the chemical laboratories at the agricultural schools and experiment stations.

The analyses are conducted solely for the enlightenment of the farmers and not for legal purposes.

Chemist: H. J. Vipond. Laboratory Assistant: L. Bischoff.

DIVISION OF FENCING AND BRANDS.

This Division administers the laws relating to fencing and brands, and publishes the Brands Directory, required by the Transvaal Act.

Controller of Fencing and Registrar of Brands: W. J. Nussey.

OFFICE OF HOUSEHOLD SCIENCE.

The duties of this office are to promote the study of household science by means of lectures, demonstrations, and correspondence.

Lecturer and Instructor: Miss J. C. van Duyn.

DIVISION OF DRY-LAND FARMING.

This Division conducts experiments and disseminates information on dry-land farming. An Experiment Station is maintained at Lichtenburg, with subsidiary ones at Pretoria, Warmbaths, and Pietersburg. Experiments in dry-farming are also conducted at the agricultural schools and experiment stations, and at other centres.

Dry land Agronomist and Manager, Experiment Station, Lichtenburg: H. S. du Toit.

DIVISION OF GRAIN INSPECTION.

This Division undertakes the grading of grain at the ports prior to export, and, if requested to do so, determines the amount of moisture present in grain intended for export.

Chief Inspector of Grain: G. F. Nussey. Government graders are stationed at the docks at Capetown, Port Elizabeth, East London, and Durban.

DIVISION OF PUBLICATIONS.

This Division edits the *Agricultural Journal* and other departmental publications.
Editor: Dr. W. Macdonald.

LIBRARY.

The object of the Library is to provide as complete a collection of agricultural literature as possible for the purpose of reference.

Librarian: P. Ribbink.

AGRICULTURAL SCHOOLS AND EXPERIMENT STATIONS.

The duties of these institutions are to provide complete courses of education extending over a period of two years and shorter courses of a technical character for persons actually engaged in farming, to instruct farmers in the area served by them on matters relating to the various phases of farming by means of personal visits, lectures, demonstrations, and correspondence. To conduct experiments, to analyse soils, manures, dairy products, etc., and to identify plants and insects and test seeds. A certain amount of pure-bred stock and of new and approved varieties of seeds are produced on the farms and disposed of to the public.

The institutions do not undertake the administration of laws relating to agriculture.

Elsenburg School of Agriculture and Experiment Station.—Station: Mulder's Vlei; distance, 1½ miles.

Sub-stations at Malmesbury and Robertson.

Principal... ... ... W. Allan.
Lecturer in Veterinary Science ... ... R. Paine.
„ Horticulture ... ... L. Tribolet.
„ Chemistry ... ... D. C. Crawford.
„ Engineering ... ... W. H. Chandler.
„ Botany and Plant Breeding ... . J. H. Neethling.
„ Dairying ... ... J. Gow.
„ Agriculture ... ... F. Fowlie.
Farm Manager ... ... Vacant.
Agricultural Assistant ... ... C. L. R. de Wet, George.

Grootfontein School of Agriculture and Experiment Station.—Station: Middelburg, Cape Province; distance, 2 miles.

Principal... ... ... R. W. Thornton.
Lecturer in Agriculture ... ...
„ Veterinary Science ... ... J. A. Robinson.
„ Engineering (acting) ... ... E. A. Morris.
„ Chemistry ... ... W. R. S. Ladell.
„ Zoology and Entomology... ... ... R. O. Wahl.
„ Dairying ... ... J. Anderson.
„ Sheep and Goats .. .. E. N. C. Warren.
„ Poultry ... ... A. Little.
„ Farm Manager ... ... Van der Merwe.

Agricultural Assistants: J. Meldal Johnson, Humansdorp; A. K. Hards, Cathcart; W. J. Lamont, Grootfontein: and Mr. Melle. Vryburg.

Potchefstroom School of Agriculture and Experiment Station.—Station: Potchefstroom; distance, 1½ miles.

Principal... ... ... E. Harrison.
Vice-Principal ... ... H. Thompson.
Lecturer in Chemistry ... ... T. G Reinecke.
„ Botany ... ... T. O. Bell.
„ Zoology and Entomology... ... ... W. Moore.
„ Veterinary Science ... ... J. R. Quinlan.
„ Engineering ... ... W. S. H. Cleghorne.
„ Poultry ... ... R. Bourlay.
„ Horticulture ... ... W. Sturm.
„ Dairying ... ... J. B. Fisher.
Farm Manager ... ... D. A. Wilson.

Cedara School of Agriculture and Experiment Station.—Station: Cedara, on farm sub-station at Winklespruit.

Principal... ... ... E. Harrison.
Lecturer in Chemistry ... ... C. Williams.
„ Biology ... ... J. Fisher.
„ Veterinary Science ... ... F. J. Curless.
„ Dairying and Poultry ... ... A. Lawrence.
„ Horticulture ... ... C. R. Parsons.
Farm Manager ... ... W. C. Mitchell.

STUD FARMS.

At these farms pure-bred animals, mainly horses, are maintained and bred for lease and sale to farmers.

Standerton Stud Farm.—Station: Standerton; distance, 11 miles. General Manager: A. McNae.

Tweespruit Stud Farm.—Station: Tweespruit, on farm. Manager: J. J. Morton.

GOVERNMENT WINE FARM, GROOT CONSTANTIA.

Visitors' Days.

It is notified by the Secretary for Agriculture that it has been decided that persons shall be allowed to visit the Government Wine Farm at Groot Constantia between the hours of 9 a.m. and 5 p.m. on Mondays, Tuesdays, and Thursdays.

Notice to Owners and Users of Machinery.

OFFICIAL STATISTICAL RETURNS.

IN terms of the Mines, Works, and Machinery Regulations Nos. 138 and 179, framed under Act No. 12 of 1911, owners and users of machinery are hereby called upon to furnish a return of all machinery erected or in use as at the 31st of December, 1912.

The forms prescribed for this purpose are obtainable gratis on application to the office of the Government Mining Engineer, P.O. Box 1132, Johannesburg, or Room 44, New Law Courts Buildings.

This return must be rendered on or before the 25th of January, 1913.

The definition of the word "machinery" is as follows:—

> "Machinery" shall mean and include stationary and portable boilers, steam apparatus, steam and other engines, including locomotives, and all appliances or combinations of appliances which can be used for developing, receiving, transmitting, or converting either mechanical or natural power, but shall not include any locomotives owned or used by the Department of Railways and Harbours.

R. N. KOTZE,
Government Mining Engineer.

The Agricultural Journal

OF THE UNION OF SOUTH AFRICA.

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Editorial Notes.

A National College of Agriculture.

It is just four years since, in the pages of the *Transvaal Agricultural Journal*, we first advocated the establishment of a National College of Agriculture free to the whole of South Africa, and now in the pages of the *Union Agricultural Journal* we can consider the question from the broader standpoint of a united people and survey the progress of the scheme. Then we reviewed the history of those magnificent endowments for the promotion of agriculture which are known in America under the names of the Morrill, the Hatch, and the Adams Agricultural Acts. Then we pointed out that, although we had our Department of Agriculture and our farmers' societies in every district, our agricultural edifice would not be complete until we had raised a great agricultural college on the corner-stone of national endowment. And then we appealed for a Government endowment fund of one million pounds. And, finally, we remarked that the people of South Africa had a chance of doing what neither the United States nor the Dominion of Canada has yet been able to do, namely, of erecting a great Agricultural College in close proximity to their Department of Agriculture, that is, in Pretoria. Such a subject seemed worthy of further study and investigation, and, accordingly, we spent our last vacation in revisiting the National Department of Agriculture at Washington, as well as the three most renowned Agricultural Colleges in America—Cornell, Wisconsin, and Minnesota. During that tour it was our good fortune to meet and confer with the builders of those three great institutions, and to publish their opinions in the form of letters for the information of the agriculturists of South Africa. To-day it would be superfluous to restate the arguments advanced by these eminent educationalists as to the vast benefits which would immediately accrue to our country from the establishment of such an institution, nor the reasons which led them to believe that Pretoria was the best

site for the college. Suffice it to say that their unanimous support strengthened our opinion as to the soundness of the scheme. And from that opinion we have never receded.

The Scheme at Washington.

One of the authorities whom we consulted while in the United States was Doctor Charles van Hise, the President of the University of Wisconsin, who, by correspondence classes and a wonderful system of extension lectures throughout the State, has carried the teaching of the University to the hearthstone of every home. A short time ago Dr. Van Hise, in an address before a meeting of the National Education Association at Chicago, made an eloquent appeal for the establishment of a National University at Washington. His arguments are so similar to those which we have already advanced in favour of a National College of Agriculture at Pretoria that they seem worthy of attention. It will be remembered by all those who followed the previous papers on this subject that we proposed to utilize the scientific and technical staff of the Union Department of Agriculture for part of the instruction in the Union or National College of Agriculture. And this is precisely what Van Hise proposes shall be done at Washington.

The idea of a National University at Washington is not that it shall be bigger than Harvard, or Yale, or Cornell, but that it shall make available for the advancement of knowledge the unparalleled facilities of Washington to post-graduate and other qualified students. With this aim in view, Professor Van Hise proposes to utilize the many important Government departments which have been established in the Federal Capital, such as the Department of Agriculture, the National Museum, the Land Office, the Geological Survey, the Bureau of Education, the Bureau of Labour, the Bureau of Statistics, the Public Health Service, the Smithsonian Institution, and the Congressional Library. In these great departments there is stored a vast amount of material suitable for scientific research; also books and manuscripts far more numerous than exist anywhere else in the United States. But these rich archives, laboratories, and museums are unknown and unused by the majority of the American scholars. Should the earnest student come to Washington in search of knowledge there is none to unlock for him those storehouses of learning, or to show him the rich treasures of science, of industry, and of art. The money spent on the National Department of Agriculture for the year 1911 amounted to over 20,000,000 dollars. The bureaux of this great department, such as Animal Husbandry, Plant Industry, Weather and Forest Service, Chemistry, Entomology, and Biology, could all be rearranged and extended, at small cost, to form laboratories for the students of the National University. Whilst the Department of Agriculture has by far the largest vote, the yearly expenditure for scientific purposes in the other branches of the service varies from 100,000 to 1,000,000 dollars. All this money, amounting every year to many millions, is more than ten times as much as is available for investigation and research in the richest university of the United States, and the scientific staff of these departments is many times larger than the staff of the largest and most famous institution

of learning. The vast collection of rare and valued books in the Congressional Library and the special collections in the various divisions cover practically the whole range of human knowledge.

It is this amazing wealth of men and material, now going to waste, that Professor Van Hise proposes should be made available for the use of scholars and investigators along every conceivable line of thought. His wide experience, both at Washington and Wisconsin, leads the Professor to maintain that the best scientific work is done by men who are likewise engaged in teaching. The official who sits at his desk for six days in the week is too often buried alive in his subject-matter. Not a few of the experts in the employ of the Government are fast becoming mere machines. They have lost their love of research. They are overburdened with clerical work. Like the man with the muck-rake in the immortal tale of the tinker, they never look up. Their spirit has been broken by lack of opportunity. Such men Van Hise would save with the stimulus of eager, questioning students. At the present moment the call for immediate results by the general public compels the departmental staff to devote the greater part of their time and energy to practical problems. In short, they have no time for private study or research. Indeed, when a member of the South African Department of Agriculture visits the National Department of Agriculture at Washington, he is struck, not so much by the magnificent buildings of white marble which have been erected during the interval of his last visit, but by the absence of any real scientific progress. And he recalls the fact that when a German scientist asked Dr. Black, the discoverer of latent heat, to show him his laboratory, the Scottish phyhicist pointed to a lump of ice, a tin kettle, and a thermometer. But if, as the Wisconsin professor wisely suggests, advanced students were permitted to enter the laboratories of the various departments to carry out research with reference to some branch of science rather than to any particular problem which may be engaging the attention of the permanent staff, the resulting benefits would soon be seen. And, further, if each year the heads of departments were obliged to give a course of lectures on the subject of their special studies, their own reputation and their value to the country at large would be greatly enhanced. But these lectures to be successful must be recognized as part of the ordinary official duties of the staff and not delivered after a hard day's work in the office, field, or laboratory. Moreover, it is suggested that the courses of study and the laboratories for students at Washington be described and circulated in the calendars of all the universities of America and abroad, while the various colleges themselves shall be invited to co-operate with the educational authorities at the capital.

Moreover, it is proposed that no student shall be permitted to work in the libraries and laboratories of the several departments until he holds the degree of Master of Science or Arts or can produce certificates of equal merit. Again, a scholar who pursues investigation at Washington shall be allowed to count his terms of residence for the doctorate of his own University. The present plan does not include the granting of degrees. Thus the proposed National University would not be a rival to existing institutions, but supplementary to them. And not supplementary to any one of them, but to all. Personally, we do not doubt that the employment of the experts of the Department of Agriculture in teaching will presently

lead to the creation of a National College of Agriculture at Washington. Such, in brief, are the main features of this great scheme.

The Plan for Pretoria.

The Union Department of Agriculture—which is now the largest and best organized in the British Empire—costs the people of South Africa three-quarters of a million sterling, or, to put it more plainly, represents the annual expenditure of eleven shillings per head of population. That is to say, the Union is spending more per individual for the development of her agricultural industry than any other country in the world. And the question naturally arises, "Is this vast sum being expended so as to produce the best results and the maximum efficiency?" According to Van Hise it is not. Like a mountain torrent in a parched land, we seem to be watching a crystal stream pouring wastefully to the sea. It is evident that something is wanting when our young men who desire a thorough training in agricultural science must exile themselves for a period of four years to pursue their studies oversea. Yet such is the case. True, we have now a chain of excellent agricultural schools beginning at Potchefstroom and ending at Elsenburg. But these are concerned, in large measure, with the practical side of farming. What we still urgently need is what General Botha five years ago, in the Transvaal Parliament, termed an "Agricultural University," or, in other words, a College of Agriculture of the highest possible standing.

The Union Department of Agriculture comprises the following offices and divisions:—Administrative Office, Veterinary Division, Veterinary Research, Sheep, Entomology, Plant Pathology and Mycology, Botany, Tobacco and Cotton, Dairying, Horticulture, Viticulture, Guano Islands, Co-operation, Chemistry, Fencing and Brands, Household Science, Dry-land Farming, Grain Inspection, Publications, Library, Agricultural Schools and Experiment Stations, Stud Farms. With the exception of the Schools, Experiment Stations, and Guano Islands, all other branches have their headquarters in Pretoria.

The National or Union Department of Agriculture for South Africa has now been established in the Administrative Capital. The permanent head, or Secretary for Agriculture, Mr. F. B. Smith, was formerly Professor of Agriculture at the Wye Agricultural College. He and his technical staff are stationed in Pretoria. It would be an easy matter for them to give a series of lectures on their respective subjects to research students in the National College of Agriculture. Again, the General Manager of the Potchefstroom Experimental Farm, Mr. Alexander Holm, has lately been transferred to Pretoria as Under-Secretary for Agricultural Education. His wide experience will always be available for advice and instruction. Mr. J. Burtt-Davy, F.L.S., the Government Botanist, and Mr. William Scherffius, M.S., the Chief of the Tobacco and Cotton Divisions, and several other members of the scientific staff of the department, have held professorships and lectureships in the leading American universities. Now, according to President Van Hise, unless the experts of the department are employed for a portion of their time in teaching, not only does it mean a great waste of State funds, but a stunting in

the mental growth and efficiency of the men themselves. No one can visit the Veterinary Research Laboratories at Onderstepoort without feeling that hundreds of farm lads in South Africa should be passing through that institution. The Veterinary Institute would naturally form a branch of the National College of Agriculture. And no one can contemplate the admirable work of Mr. I. B. Pole Evans without realizing the urgent need for an Institute of Plant Diseases in Pretoria. It does seem strange that his researches are better known to the scientists of Europe than to the agriculturists of South Africa. Yet so confined is his laboratory space that there is no place to turn save you turn out.

Other Government departments, such as Lands and Irrigation, Surveys and Meteorology, Land Bank and Statistics, Commerce and Industries, would also afford valuable material for agricultural students studying in Pretoria. After all, our efficiency as a department of State must stand or fall with our service to South Africa and to humanity. And no one can deny that to use the scientific staff of the Union Department of Agriculture in a National College of Agriculture would greatly increase the efficiency of each individual member and place at the disposal of the earnest student an accumulation of experience garnered over many years.

It is sometimes said, and we confess we hear it with a certain amount of amusement, that there are too few students in South Africa to justify the establishment of a great College of Agriculture. The other day the death was announced of Doctor W. W. Daniels, the founder of the study of chemistry at the University ot Wisconsin. In 1868 he was appointed to a chair in that institution, and established its first chemical laboratory, giving daily instruction to *one student* on a carpenter's bench in the basement. In America if there is a solitary student to be taught the State at once provides a professor.

Apart from our farmers, their wives, and sons and daughters, all of whom should be reached by the extension work of a modern College of Agriculture, and, apart from the teachers in all the schools of South Africa, there are in Pretoria alone some five thousand persons in Government employ. And we have yet to meet a Government official who is not interested in agriculture, horticulture, dairying, floriculture, or poultry. They have their gardens, and one day they all hope to have their farms. But we think in sadness of the monotonous life of many of these men. Pretoria has few places of amusement. It lacks the sea and the flower-decked mountain slopes of the southern capital. But it might be made, by a little patriotic effort, a city of learning and of continuous and rich discovery in science, literature, and the arts. It certainly is clearly destined to become the agricultural Mecca of South Africa. A National College of Agriculture, with day and night classes, would open to many a farmer's lad, and to not a few townsfolk, those avenues of learning which lead alike to wisdom more precious than rubies, to fortune, and to fame.

Scope and Site.

The progress of the scheme is best seen in the recent letter addressed by Mr. F. B. Smith, Secretary for Agriculture, to the South African Agricultural Union, in reply to a request for particulars

regarding the scope of the proposed college. Mr. Smith wrote: "I am directed by the Right Honourable the Acting Minister of Agriculture (General Botha) to acknowledge receipt of your letter dated 9th instant, and to state that the Transvaal College of Agriculture—which it is hoped will serve the purpose of a National Agricultural College—was established by the Transvaal College of Agriculture Corporation Act, 1910, which Act sets forth the constitution of the College.

PROFESSOR L. H BAILEY, LL D, Director of the New York State College of Agriculture (Cornell University) He is the most eminent living agriculturist, and may justly be termed "The Father of Modern Agriculture"

"The Municipality of Pretoria gave the farm Groenkloof to the Government for the purpose of providing a site for the college, and the late Transvaal Government allotted a sum of £100,000 for the purposes of the college. The farm has been duly made over to the Government, but the £100,000 is not yet available, as it has to be obtained from the repayments of the repatriation loans. As its name implies, the college will be of university standard, that is to say, for post-matriculation students and for research."

Groenkloof, or the green glen, the magnificent estate gifted by the Town Council of Pretoria as a site for the National College of Agriculture, comprises an area of 3681 acres, and is situated less than two miles from the centre of the city. It forms an ideal site for a great College of Agriculture. Indeed, no grander ground could have been found in the whole of South Africa. The site chosen for the college buildings is the most beautiful, picturesque, and healthful in the neighbourhood of the capital. Mr. Herbert Baker, the eminent architect, has pronounced in its favour in glowing terms. The soil of the farm is suitable for a variety of agricultural experiments, rich alluvial loams in the valley, and, on the higher slopes, several hundred acres of deep and fertile dry lands. The well-grassed hills will afford admirable grazing for pedigree flocks and herds, and practical instruction in live stock. There is ample scope for the teaching of General Agriculture, Horticulture, Economic Botany, Dry Farming, Irrigation, Forestry, Dairying, Landscape Gardening, Floriculture, and Nature Study. The Botanical Experiment Station, a branch of the Department of Agriculture, has now been established on the property under the supervision of Mr. J. Burtt-Davy, as well as the Government Dry-land Station under Captain Heinrick S. du Toit, the Dry-land Agronomist. When we recall the wonderful results won by Mr. Du Toit on the shallow, sandy soil at Lichtenburg, it is not too much to expect even more marked results at Pretoria, where the soil is richer and the rainfall heavier. But whereas one farmer can find time to visit the Dry-land Station at Lichtenburg, scores of farmers will be able to study on the spot the experiments of the more central station at Pretoria. Furthermore, it is hoped that facilities will be offered in the near future for students to study on the dry-land station. The recent lectures delivered by Captain Du Toit throughout the country districts of the Union have resulted in a great demand for instruction in this new branch of agricultural science, and it is

safe to say that were a School of Dry Farming started at Groenkloof a hundred young farmers would register to-morrow.

What we need in the agricultural teaching of to-day is something of the enthusiasm for learning that inspired those thirty thousand students to beg by the wayside from Padua and Salamanca in order that they might reach Paris and sit at the feet of the great teacher Abelard. In conclusion, we may mention that Groenkloof lies within easy range of the Transvaal University College, and will thus afford that intermingling of students during the impressionable years of their youth so essential in an agricultural college which seeks not only to nourish and sustain a great industry, but at the same time to impart a broad and liberal culture.

THE HON. ANDREW D. WHITE, LL.D
First President and Builder of Cornell.

Some time ago, when speaking on the subject of "University Education," Lord Rosebery remarked that the great progress made by the University of Glasgow in comparison with the University of London was mainly due to the fact that the former institution (Glasgow) had always been wedded to the city as well as being nurtured by the State. In the same way we believe that the sympathetic support and practical co-operation of the Town Council of the Administrative Capital cannot fail to prove of lasting benefit to a National College of Agriculture. Macaulay, in his brilliant inaugural address as Lord Rector, delivered at Glasgow in the year 1849, traced the foundation of that University by Pope Nicholas the Fifth on the lines of Bologna. We, too, may well look for a model for our National College of Agriculture. For ourselves we know of none so suitable as the New York State College of Agriculture at Cornell. For no institution of learning has had a more romantic history, none has achieved so much in the space of a single generation, and none has done more for the toiler on the land. Founded by the poor Quaker lad, Ezra Cornell; presided over by America's most eminent scholar, philosopher, and diplomatist, Andrew D. White; and made famous by the greatest teacher of modern agriculture, Liberty H. Bailey, it is small wonder that in less than half a century the influence of this college has been felt throughout the civilized world. We have no time to sketch the rise and growth of Cornell, but, in passing, we may remark that both Dr. White and Professor Bailey were warmly interested in the scheme for the establishment of a great College of Agriculture in Pretoria. Professor Bailey said: "I hope that the movement for a well-endowed College of Agriculture in the Transvaal will be successful. I should think it would be absolutely essential to the best internal development of the country and to establishing it substantially in the markets of the world and in the estimation of other peoples." Dr. White has now reached the ripe age of eighty. But his industry and his intellect are such as no age can diminish. For us he traced the early struggles of Cornell—the man and the institution. And his parting words as he said farewell on the Campus were these: "Remember that it is not a

wise policy to establish an agricultural college in a locality by itself. For its work should always be before the public. In the early days Cornell nearly lost her appropriation because the town of Ithaca was so small and so far away from the seat of Government that the legislators and men of wealth could not see the good work which we were doing and consequently took little or no interest in the affairs of the College of Agriculture." "Good-bye," he said again, and paused to add impressively, "Don't forget to tell your Government and the people of the Transvaal from me that the best place for their College of Agriculture is in the capital of their State." So spoke the foremost educationalist in America—the builder of Cornell. And his words are as true to-day in the larger life of the Union.

ARTHUR YOUNG, F.R.S.

"The magic of property turns sand to gold."

The Work of Arthur Young.

In the pages of the *Agricultural Journal* we propose from time to time to set down the opinions of progressive farmers for the information of our readers. The time is now ripe for such disquisitions. Twelve years ago this great country was in the throes of an unhappy war. Then followed a strenuous period of reconstruction, when most men were too busy to talk or too new to discuss the conditions of their respective districts. But all this is past. We are entering a wonderful agricultural era, for we live in the richest and grandest undeveloped region in the world.

Moreover, we are rapidly evolving a distinct South African agriculture. Our farming methods are different from those of other countries, and whilst we must ever be eager to learn from other lands we must also work out our own salvation. In travelling throughout the Union we hear the opinions of many farmers who can speak with authority, and whose experience cannot fail to be of value to the country at large. In collecting such data we are but following the precedent of Arthur Young. He was the father of the agricultural tour, and he gave to the world the thoughts and ideas of contemporary farmers, together with a mead of praise or blame. His verdict might be right or wrong. He was far from infallible, but by his writings he revolutionized the agricultural industry of England and Europe.

Arthur Young, the greatest of English agriculturalists and the poorest of practical farmers, was born at Whitehall, London, in the year 1741. He was the youngest son of the Reverend Dr. Arthur Young, Prebendary of Canterbury Cathedral, Rector of Bradfield, and of Anne Lucretia, daughter of John de Cousmaker, a Dutchman who accompanied William of Orange to England. From his father, Arthur inherited good looks and literary talent; and from his mother the love of learning and brilliant and pleasing speech. In the year 1784 Young began the publication of the *Annals of Agriculture*, a monthly publication which ran through forty-five volumes. These annals covered the whole field of agriculture in the form of letters and essays from the most eminent ruralists of the age. But more than a fourth part of the whole series came from his own facile pen. He tells us, with much pride, that the King was persuaded to contribute two letters under the nom de plume of "Ralph Robinson," his shepherd, and that His Majesty said to him one day on the terrace at Windsor: "Mr. Young, I consider myself as more obliged to you than to any other man in my dominions"; while the Queen observed that they never travelled without a copy of the *Annals* in the Royal carriage. These volumes created quite a stir in European circles, and from all parts of the Continent there flocked scholars to study at the feet of this Gamaliel of English agriculture.

If Tull was the founder of dry farming and Coke the father of the experimental farm, Young was unquestionably the author of the agricultural tour. He travelled widely throughout England, and wrote "The Southern," "The Northern," and "The Eastern Tours," together with "The Tour in Ireland." The first three tours were translated into Russian by command of the Empress Catherine, who at the same time sent several young Russians to reside at his home at Bradfield for instruction in British agriculture. Young said that the most useful feature of his agricultural tours was the practical information which they gave on the correct rotation of crops, a matter upon which all preceding writers had been silent. But his most famous and popular work was his "Travels in France." These remarkable journeys were foreshadowed twenty years before in a little book entitled "The Farmer's Letters to the People of England," in which he says:—"The nobility and men of large fortune travel, but no farmers; unfortunately, those who have this peculiar and distinguishing advantage, the noble opportunity of benefiting themselves and their country, seldom inquire or even think about agriculture."

It is impossible in this brief sketch to do more than mention the writings of Young. His career we must reserve for a subsequent paper. The library of our department is far from complete, yet we possess sixty-six volumes of his sparkling prose, which, placed one upon another, attain to a height of 9 feet—a monument of amazing industry. True, he was not exempt from those petty jealousies which so often mar the character of eminent men. He tried to snatch some credit for the Board of Agriculture from Sir John Sinclair, and he scoffed at the idea that Jethro Tull had invented the corn drill. He met and conversed with the greatest savants of the age, yet his mind never burst the old wine bottles which he served out as a lad in the Suffolk store. And so he arrogantly says that Canada and Nova Scotia are not worth colonizing. "If they continue poor, they will

be no markets. If rich they will revolt; and that perhaps is the best thing they can do for our interest. The loss of India must come. It ought to come." Yet with all his vanities and foolish fancies what a splendid life! For he was the Prophet of the New Agriculture in the Valley of Dry Bones. And England may well write the epitaph of her illustrious son in the words of Ezekiel: "This land that was desolate is become like the Garden of Eden."

An Orange Farm.

The other day we had occasion to visit the farm of Buffelspoort No. 668, which lies fifty-five miles from Pretoria and fourteen miles from Rustenburg. Some twenty miles out from the capital, just beyond the Crocodile River, you pass through the purple Magaliesberg mountains at Commando Nek, and descend westward into that warm bush-studded valley which has become so famous for the cultivation of oranges and tobacco. It is curious to reflect that these mountains form the dividing line between the orange and the apple zone. Northwards, the orange does best; southwards, the apple. So here we find an interesting lesson concerning agricultural zones, and the adaptability of certain climates and soils to certain crops. We do not know of any land in the Transvaal more fertile, soft, and mellow than the deep, rich, chocolate loams of the Rustenburg valley. These soils are formed by the weathering of igneous rocks and quartzites.

The farm of Buffelspoort belongs to the Rustenburg Citrus Growers—a small company which has recently been formed to develop the property. The manager-in-chief, Mr. John B. Bright, is a man of arresting personality. He was born in Virginia, has fought in three wars, and for a period of six peaceful years held the post of manager of the Botanical Experimental Station at Skinners Court, Pretoria. He left the Department of Agriculture to develop the property at Buffelspoort. The past history of this farm is illuminating. When Bright first unfolded his tent and took possession, it was loaded with debt, and tangled up with interminable grazing rights, which prevented both ploughing and planting. But the Southerner is a soft-spoken, patient man. He merely wanted to cultivate the waste land and grow his orange trees. He can do so now. He reminds us of Stonewall Jackson. There are two other managers, Mr. R. B. Smith, an engineer by profession, who left the deep levels of the Rand for the deep soils of Rustenburg, and Mr. Thomas Pallister, who has farmed in England, Rhodesia, and Portuguese East Africa. There may be three more industrious men in South Africa, but we have not met them.

We put a few questions to Mr. Bright.

Kindly tell us about your work?

With pleasure. The farm of Buffelspoort comprises 4500 acres. We have a splendid supply of water, and the finest citrus soil in the whole district. Our ultimate aim is to put the whole farm under citrus fruits. We are planting 10,000 trees every year, and purpose having a total of from 50,000 to 70,000 trees. We are planting out at the rate of 100 trees to the acre, that is 22 feet apart in triangles. We have had great difficulty in getting young trees in South Africa, as the nurserymen are all sold out, and we cannot import from

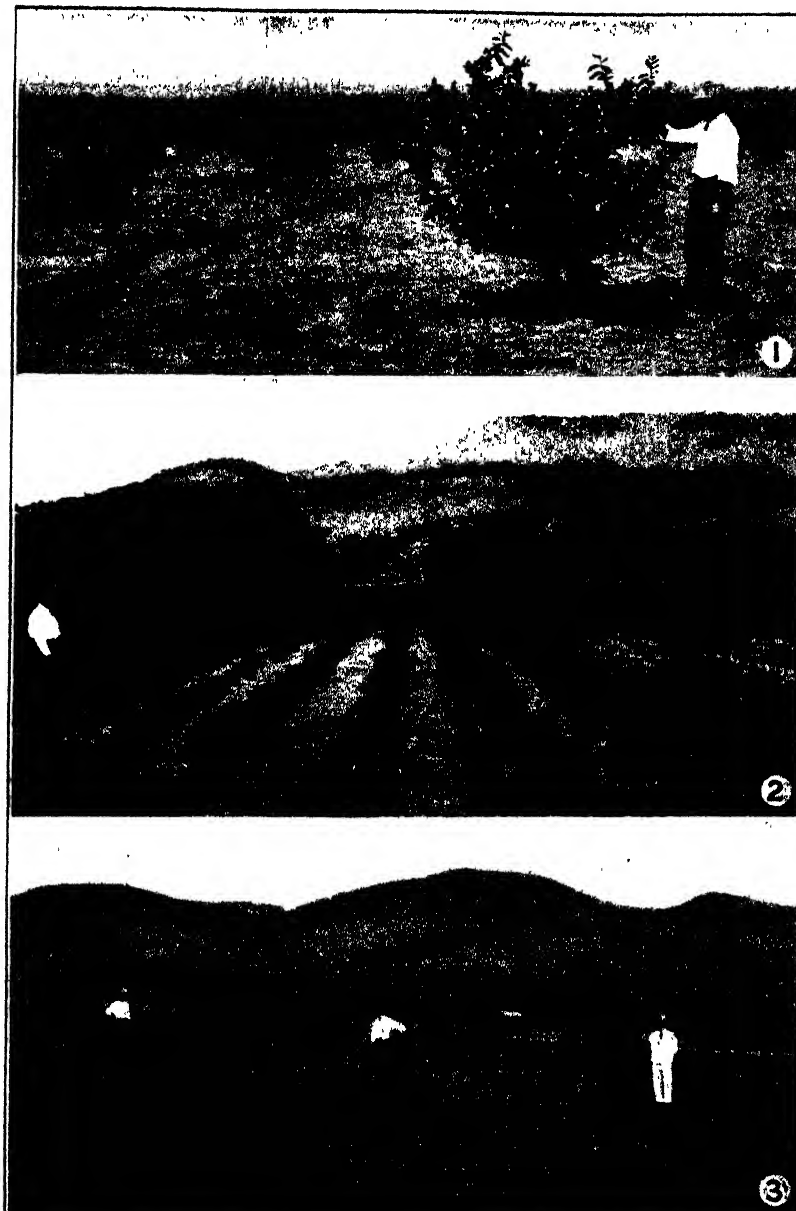

Plate No. X.

1. Lemon Tree planted by Lord Selborne at Buffelspoort, Rustenburg. 2. Orange Nursery; budding 20,000 seedlings. 3. Laying out Orange Orchard (Messrs. Smith, Bright, and Pallister).

California owing to the Government regulations. We have just bought 10,000 citrus trees at 2s. 6d. per tree. Next year we shall not buy any, as we are now raising them ourselves. There is going to be an enormous demand for citrus stocks throughout South Africa, and intelligent nurserymen should make a fortune. We are going to bud 20,000 next year. We are budding the Washington Navel orange on rough lemon stock. It is the best stock for this country, being more drought-resistant than all others, and was first brought to South Africa by the Portuguese.

As I have already remarked, we are fortunate in possessing an ample supply of water, which is conveyed to our lands in flumes over a distance of seven miles. We water our young trees every three or four weeks, but our old trees only get two or three irrigations per year.

Are you planting for export?

Yes, entirely. We are only planting Washington Navels. They are the best oranges for export, and we reckon on from 500 to 1000 oranges per tree after six or seven years. Full-bearing trees after seven years will bring in £100 per acre, or at the rate of £1 per tree.

We are also growing lemons, but not for the oversea trade. We do not propose to compete with Spain or Portugal in this commodity. But at the present moment South Africa is importing a lot of lemons, and we do not see why we should not supply some of the local markets. Lemons are not as good a fruit for export oversea as oranges. Last season we made as much as £4 per tree off some of our lemons. The best varieties to plant are Villa Franca, Genoa, and Eureka. I need hardly remark that oranges and lemons should never be mixed in the same orchard. On my arrival here I found that my predecessor had planted lemons amongst the oranges, with the result than cross fertilization took place, and the seedless Washington Navel oranges now have seeds, while the smooth-skinned lemons have grotesque navel marks.

We are only planting a few naartjes, as we do not consider them a good enough fruit for export. In fact, I may say we are not going to bother about the local markets of South Africa. We are going to capture the oversea trade.

The Transvaal produces the finest oranges in the world for export. This is due to our warm, dry climate and our rich, well-drained soils. Our oranges are better for export than those grown along the coast of Natal or in the Cape Province, being lower in moisture content. We can grow oranges equal to the best grown in California, and we can place our oranges on the London market at much less cost than the citrus growers of the Pacific Coast. Again, we can land our citrus fruits in England during the off season in California; that is, from the beginning of May till the end of September. It is true that Australia can do likewise, but she is heavily handicapped by being so much further from England, and farm labour is costly, while ours is cheap. In any case, we need fear no country, because, all things considered, we possess the best orange country in the world.

You asked me a short time ago what was the price of good orange land in the District of Rustenburg. It is rather hard to say exactly, but the best land under water is now selling at £50 per acre, which may also include some dry land for grazing. Personally, I do not

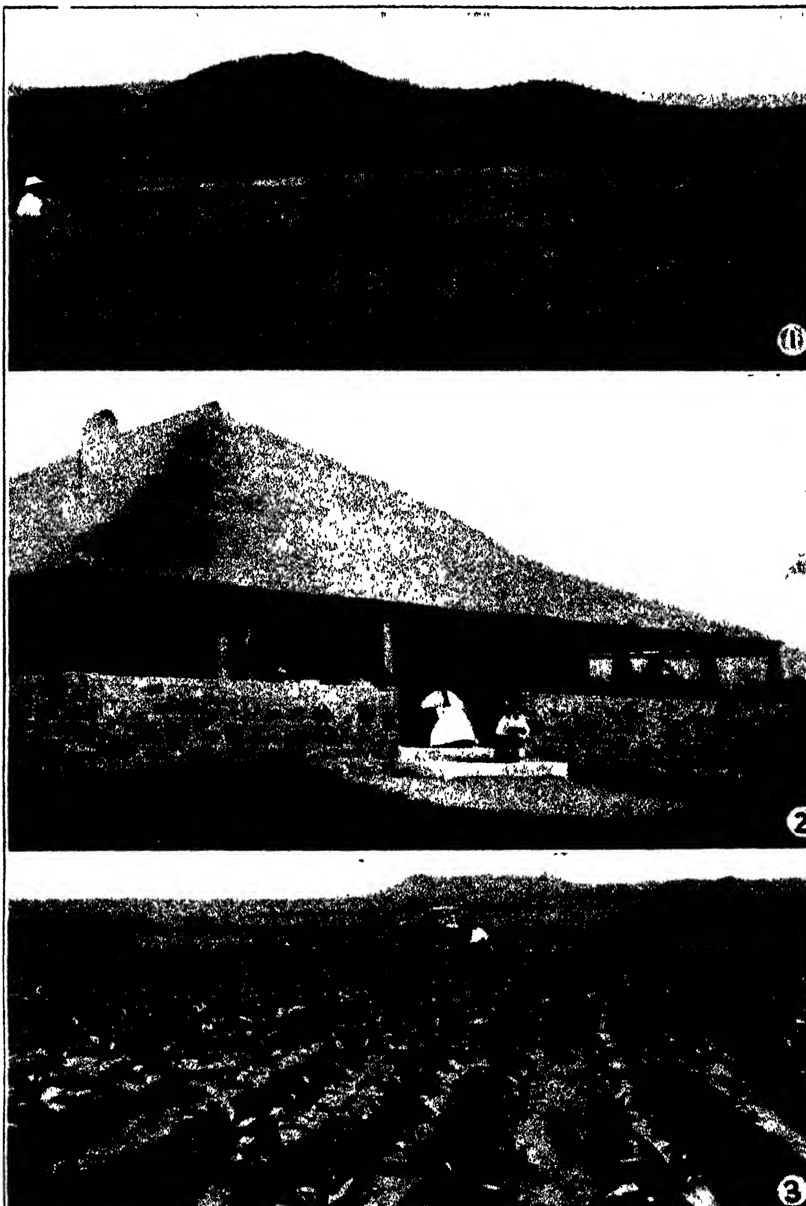

Plate No. XI.

1. Clearing Bushveld for Citrus Growing. Orange Orchards and Magaliesberg Mountains in background. 2. The Homestead at Buffelspoort. 3. Irrigating Tobacco.

think that citrus fruits can be grown successfully on the dry-land system. Still, if it could be done, and made to pay, it would revolutionize the orange industry of this district, because, although irrigable land is very expensive, good dry land is cheap, and can be bought for a pound or two per morgen (two and one-ninth acres).

What will you do until your orange trees come into bearing?

Grow tobacco. We are going in for tobacco on a large scale. We have just started, but last year we made £2000 clear profit on this crop. We planted Yellow Pryor for cigarettes, and we have literally been persecuted by the United Tobacco Company of Rustenburg to grow more. They cannot get sufficient good yellow tobacco in South Africa for their factory. We have built flue-barns and air-curing sheds. The advantage of flue-curing by hot air is that we can control the colour of the leaf, which is very important. Furthermore, we don't have to wait for rain to moisten the tobacco. We use steam. In the old style of air-curing shed, so common in the Transvaal, you must wait for rain, and, meanwhile, the wind plays havoc with your leaf.

We find that our crop works out at from 800 to 1000 lb. per acre, at a price varying from 6d. to 1s. 3d. per lb. We calculate on an average production of £40 per acre. Tobacco is a grand crop for small holdings, so little land is required for handsome profits. There is a splendid future for tobacco growing in the Transvaal, so long as the present duty is retained. We have been greatly helped and saved many costly mistakes by the Government Tobacco Station at Rustenburg.

What do you think of the agricultural progress of South Africa compared with the United States?

There is absolutely no comparison. At the present moment South Africa is standing still so far as the farming industry is concerned. It is impossible for any country to go ahead without immigration. Immigration is the life-blood of all new countries, and if it is checked or discouraged the vital circulation of a nation soon ceases. In the Transvaal the Union Government owns over 20,000,000 acres of excellent farm land. But it is all locked up. In this district alone (Rustenburg) I find, on looking up official statistics, that there are nearly 1,000,000 acres of Government land. The Federal Government of the United States would immediately throw open these lands free to industrious settlers. Land settlement in America is never made a mere party question. It is a national question, and all legislation is based on the free farm, and a hearty welcome to the oversea immigrant. But Government land in this country is all tied up, and the Government is making no use of it. There are thousands of acres of Government land in South Africa which would produce magnificent crops of oranges, tobacco, cotton, and fibre plants. The United States Government would immediately cut up this land into quarter-sections (160 acres), half-sections (320 acres), and whole sections (640 acres), and throw it open for settlement. South Africa will never advance until something practical is done to attract those thousands of settlers who are now pouring into the United States and the other British dominions. We talk, but do nothing. I cannot understand why South Africa should be afraid to import honest, hard-working English, Dutch, Scottish, and American colonists when all other new countries are

straining every nerve to induce them to settle, to build homes, and to develop the trackless prairie. I am also amazed that nothing is being done by the Government to advertise the Union in Great Britain and the United States.

We want men and money. Agriculture has a great future in South Africa, if supported by industries, but without factories it has no future at all. And so it all comes back to the urgent need of immigration. It surprises me beyond measure that our farmers do not seem to see that an influx of settlers will raise the value of our farms, open up new markets for our produce, and bring not poverty but great and immediate prosperity. But without closer settlement the agricultural future of South Africa is dark indeed.

We would like to call attention to this interview. We feel sure that our readers will be struck by the straightforward sincerity of Mr. Bright's remarks. We have heard much about the secrets of the South African ostrich industry and the latent fear of foreign competition. There are no secrets in orange growing. The three partners at Buffelspoort do not fear competition. They are beyond it by reason of their knowledge, their cheerful enthusiasm, and their simple colossal industry.

Progress in Plant Pathology.

It is probable that few farmers are fully aware of the work of the Division of Plant Pathology, because the remedies for fungoid diseases are more frequently found in the laboratory than in the field. But the vast importance of this work and its value to the farming community can best be realized by a short account of the progress of the division. Mr. I. B. Pole Evans, M.A., Plant Pathologist, is continuing his investigations into the life-history of the various rusts which are parasitic on maize, wheat, and oats, and the allied members of the grass family. He has recently found that the alternate host of the maize rust in South Africa is the little yellow oxalis (*O. corniculata*), commonly known as sour grass or sorrel. It therefore behoves our farmers to diligently hoe out this weed wherever it appears. The native Acacia or thorn trees are also afflicted with various rusts, which are being systematically studied in the greenhouse attached to the laboratory in view of the fact that one day they may become a possible source of danger to wattle plantations. Still more important researches relative to the wattle at present being carried out are those which have for their object the destruction of the bag-worm. As is well known, this insect is defoliating hundreds of acres of wattle plantations in Natal. Happily it is attacked by a fungus which is now being cultivated in the laboratory and which will be distributed artificially throughout the plantations for the purpose of spreading disease amongst the insects. Mr. Pole Evans has also recently received from Natal a fungus which is parasitic upon the white ant, and hopes one day to propagate it in large quantities and put it to some economic use. Most potato growers in England are unfortunately familiar with the disease known as black scab or wart disease. The division has taken prompt and vigorous measures to prevent the introduction of this trouble into South Africa, and it is worthy of note that

such action against black scab or wart disease is now being followed by all progressive countries in the world. No potatoes are allowed into the Union unless they are accompanied with a certificate stating where they were grown and that they have come from districts free of the disease. But the United States have quite recently gone even further, and have absolutely prohibited the importation of all potatoes from England. France is regarded as a clean area, being still free from the disease. From these facts we may deduce two things—that it is a wise policy (1) to grow our own seed potatoes, and (2) to grow them on dry lands, as over-irrigation tends to favour this disease.

The indefinable border line between the animal and plant world is well seen in the brilliant researches of Dr. Erwin F. Smith, of Washington, on cancerous growths of trees and shrubs. And the question which is now forcing itself upon the scientific world is whether the cancer of humanity is caused by similar organisms as those which cause abnormal growths on branches and trunks of trees. In any case it is instructive to know that the Plant Pathologist can induce these growths upon trees at will by means of inoculation. The largest cancer growth on record—that on the stem of a willow tree—is to be seen in the laboratory, as well as a large collection of these growths on a variety of plants.

It is strange to think that researches bearing on the prevention of miners' phthisis have also fallen within the scope of the Division of Plant Pathology during the past year. In the endeavour to keep down the injurious dust in the mines on the Rand, sprays and spraying solutions of various kinds have been tried. One of the most promising of these has been a sugar solution used by Mr. Lancelot Usher, which, however, was found to have certain disadvantages, in that it induced the growth of mould, fungi, and fermentating organisms. This aspect of the question was brought to the notice of the Division of Plant Pathology and Mycology, and means were discovered whereby the trouble can be overcome, with the result that the interior of the mines thus sprayed may now be kept in a more hygienic condition than formerly. The division is also investigating an obscure disease of cheeses from East Griqualand which appears in the form of red spots; while the gumming of wattles is also under investigation.

Miss Ethel Doidge, M.A., Assistant Plant Pathologist, is pursuing research upon a new bacterial disease in mangoes. It is found in Barberton, Warmbaths, and the coast districts of Natal. This disease may be recognized by the formation of small angular black spots on the leaves and branches and brown spots on the fruits which crack open. So far experiments have shown that the usual fungicides are useless against the disease. Next April the Division of Plant Pathology will take over the Colonial Herbarium attached to the Durban Botanic Gardens, and will establish there a laboratory for the investigation of diseases of tropical and sub-tropical crops and fruits. The work of this division is of such importance to the agricultural community of South Africa as to warrant much better laboratory facilities in Pretoria and an extension of the present staff.

Live Stock in South Africa.

A few years ago a farmer from South Africa happened to visit America. He bore a letter of introduction to Mr. Armour, of Chicago,

He was warmly welcomed by the plain-living, simple-minded millionaire. But what surprised him most of all was the intimate knowledge of this country possessed by the meat merchant of Chicago, and when he made this remark Mr. Armour merely smiled and said: "Well, you see, it is my business to know these things. Down there in South Africa you have the grandest ranching country in the world. Just think of the thousands of head of wild game that used to roam over the Kalahari Desert, Bechuanaland, and Southern Rhodesia. I must have grazing lands for my business here in Chicago. The great ranches of Texas and the Far West are being rapidly cut up into homesteads, and the same thing is happening in Canada, but your glorious veld could support millions of cattle to supply the live stock markets of England, the United States, and Europe. I have been watching South Africa for some time past. It only needs industry and enterprise to make it a great land."

The last report issued by Mr. James Irvine Smith, M.R.C.V.S., Director of the Abattoir and Live Stock Market of Johannesburg, bears out Mr. Armour's contention. We congratulate the Municipal Council of Johannesburg on the progress of their live stock industry, and the director upon compiling a report more fascinating than many a novel, and of far more use to the community at large. We do not know if this report has been printed, but we hope that His Worship the Mayor will give instructions that it be widely circulated amongst the farming community.

Personally, we feel proud of Johannesburg when we learn that more animals pass through her abattoirs than either at Glasgow or Manchester. Let us study these figures: During last year a total of 976,134 animals and 3660 vehicles passed through the markets of the Golden City. This represents a turnover of £3,143,117, thereby ranking Johannesburg as one of the largest live stock markets in the world. In the same period 453,736 animals were slaughtered in the abattoir. Here is the comparison with Glasgow and Manchester:—

Town.	Number of Abattoirs.	Population.	Total number of animals slaughtered in one year.
Glasgow...	4	884,520	432,849
Manchester	3 and private slaughter-houses	716,354	378,816
Johannesburg	1	237,220	453,736

Taking the total population of Johannesburg at 237,220, the figures given by the last census, we note that the daily meat consumption is 736 lb., or approximately ¾ lb. per head. The experts at the abattoir discovered 305 cases of tuberculosis. Their statistics show that Africander oxen and cows are rarely infected with the disease, about 1 in 10,000, whereas amongst the imported pedigree milch cows or their progeny the tuberculin test has revealed an infection of from 5 per cent. to 87 per cent.

It is also of interest to study the census of sheep and cattle in the various meat-exporting countries:—

Country.	Sheep.	Horned Cattle.
Argentine...	67,000,000	29,000,000
Australia	92,000,000	11,000,000
Canada	3,000,000	7,000,000
South Africa... ...	45,000,000	6,000,000

There is but little doubt that the Johannesburg Municipality will ere long take advantage of this growing industry to erect an up-to-date refrigerating plant and develop themselves a frozen meat trade under expert control and grading, as has been done by the Governments of Australia and New Zealand.

Land Settlement in Rhodesia.

It is with much pleasure that we call attention to an illustrated handbook, entitled " Become a Rhodesian Farmer," issued conjointly by the Rhodesia Railways and the South African Railway Administration. This handbook is brightly and carefully written, and is an honest endeavour to set forth the agricultural prospects of Rhodesia before the intending emigrant. We do not doubt that it will be the means of inducing many settlers to throw in their lot with our great northern neighbour. Should Rhodesia adopt a generous and progressive immigration policy there seems no reason why she might not rapidly become a much more powerful country than the Union, and eventually absorb the four Provinces of the Cape, Free State, Transvaal, and Natal. After all, a single stream of immigrants for one year at the United States figure, or for two years at the Canadian total, would give her a population equal to the Union of South Africa. At the Victoria Falls there must eventually arise a great milling city similar to Minneapolis, where half a million people are now concentrated.

In Rhodesia the colonist with a capital of from £800 to £1000, and average ability, not only secures a comfortable competence, but has a fair prospect of ultimate affluence, with the option of acquiring from two or three thousand acres of land at the present average price of four shillings per acre—land which by development may become as valuable as farming land in Great Britain. Another consideration of importance to married settlers is that Rhodesia is exceptionally well endowed for educational purposes by the Rhodes and Beit bequests. The British South Africa Company is prepared to sell, or lease with option of purchase, land in Southern Rhodesia upon exceedingly favourable terms. Naturally, the price of land varies according to its situation. The present price of unimproved land is about 8s. to 10s. per morgen. Irrigible land suitable for intensive cultivation commands a higher sum. The price in each case is fixed after a careful inspection of the land, and includes cost of survey of areas not less than 500 morgen.

Land may be purchased for cash, subject to the fulfilment of a simple occupation condition, or it may be held under a permit of occupation, with option of purchase for cash or by instalments at any time within ten years. The following statement of crop statistics will be of interest to our farmers:—

Probably no country in the world is better suited for maize growing than Southern Rhodesia. Without fertilizing, and with only ordinary tillage, the average soil of Southern Rhodesia yields from 1000 to 1800 lb., and the best Rhodesian soil from 2000 to 3000 lb. of maize per acre; specially good patches yield double the latter amount. Stretches of poor or badly prepared land of course reduce the average yield, so that perhaps the fairest estimate is an average figure of 1600

lb. (8 bags) per acre after the second season. Taking the local selling price of Rhodesian maize at the low figure of 7s. 6d., and placing the cost of production at the fairly high figure of 4s. 9d., the profit on maize growing may be said to be not less than 2s. 9d. per 200 lb. In other words, there is a return from the average 300 acres yielding 1600 lb. per acre of not less than £330 per annum. The average Rhodesian farmer starting with a capital of £800 handles from 200 to 300 acres of maize by his third season, and should make about £400 on the crop.

After maize, tobacco is the most important crop at present grown in Rhodesia. The different kinds of Rhodesian soil are suitable for Turkish or Virginia cigarette tobacco, as well as for pipe tobacco, and crops of excellent quality are produced. The leaf widely grown in Southern Rhodesia is a light Virginian for cigarette tobacco. It is raised and cured by the grower, at an average cost of about £10 to £12 per acre, and returns from £20 to £35 per acre. In other words, the profit reaped from the average thirty-five acres is anything from about £300 to £800 per annum, according to the efficiency of the farmer in growing and curing his crop. For the sake of our oversea readers of the *Agricultural Journal*, we may mention that Rhodesia is represented throughout Great Britain by agents, and any one wishing to know the name of the nearest agent should write to the Superintendent of Emigration, 138 Strand, London, who will give all information regarding assisted rail passages, conveyance of goods, and steamer routes, and cost of transport. When does the Union propose to do likewise?

The Month and the Magazines.

Before we touch on the magazines of other countries we would like to call the attention of our readers to the *Farmers' Weekly*, which is published in Bloemfontein. This admirable periodical covers every branch of the agricultural industry. It is brightly written, always improving, and should be in the home of every farmer in South Africa.

In a recent number of the *Breeders' Gazette* there is an article of special interest to South African farmers, entitled "Associated Effort in Tick Eradication." Six years ago the Bureau of Animal Industry began the great task of eradicating, in the southern part of the United States, the ticks which are responsible for the spread of Texas fever. A quarantine line was arbitrarily fixed after thorough investigation. It ran irregularly from the coast of North Carolina to the Imperial Valley in Southern California. All infested territory lay south of the line. Then the bureau began, in co-operation with State and local authorities, its work of killing the fever-spreading ticks, releasing from quarantine the first year more than 10,000 square miles. Much more than one-fifth of the total original infested area has now been freed from the pest. Up to the present time the released territory totals about 150,000 square miles, equal to 96,000,000 acres, which is more than twice the size of Iowa. Large blocks of tick country are officially reclaimed every few months, so that the quarantine line is dropping ever southward. The tick-infested region is being cleared by the use of arsenical dips prepared by the bureau.

The *New Zealand Farmer, Stock and Station Journal* has an interesting paper on the Hawkesbury Agricultural College in New South Wales, in which special mention is made of the Government scholars, Messrs. E. N. Roberts and Mr. G. N. Schuurman, who are studying at that institution. Both have taken their diploma, while Mr. Schuurman has won the gold medal as the best all-round student in the college. It is the industry and enthusiasm of such young men that will make South Africa the foremost agricultural country in the British Empire.

The *Pacific Rural Press* tells the story of the opening up for settlement of the Salt River Valley in Arizona on the completion of the great Roosevelt Dam. This dam is the most important piece of work of the United States Reclamation Service. It is 280 feet high, and has a crest 1170 feet long. The reservoir when filled will cover 16,320 acres, making nearly twenty-six square miles of water. It can hold sufficient water to cover 1,284,000 acres one foot deep. Under the canals of the project are 230,000 acres, of which 150,000 have been settled, and the remainder is now open for settlement. This water is furnished to landowners under the dam for $1.60 (6s. 6d.) per acre per annum. The dam and equipment not only provide water but also electric power. The average annual rainfall of this region is 7 to 8 inches, and the soil, like most desert soils, is rich and deep. Lucerne and citrus fruits will be largely grown, and the cattle and ostrich industries are being rapidly developed. We learn that 7000 ostriches are now running on the land under the dam, being 80 per cent. of the total birds now in the United States.

The *North British Agriculturist* is gratified at the prospect of a seed-testing station for Scotland. Hitherto all seeds when required to be tested have had to be sent either to private individuals, the botanists of agricultural societies, the Irish Agricultural Department, or to Switzerland or Germany. The Scottish farmer is being confused by the varying nature of these tests. The explanation is simple. Under the Continental (Stebler) system all light and immature seeds are regarded as impurities, and, consequently, the results show low purity and high growth when compared with the British method, which only eliminates foreign seeds and weeds. A more uniform system of testing is clearly wanted, alike in the interests of buyers and sellers. It is probable that the scale of fees will be similar to those of the Irish Board, say 2s. per sample for purity and germination to seedsmen, and 3d. per sample in the case of bona fide farmers.

The *American Miller* announces that the International Harvester Company, of Chicago, will spend one million dollars in promoting scientific agriculture. A service bureau is to be established, with Professor P. G. Holden, of the Iowa State College, as its head. Mr. Holden, who has given up his position in the college to enter the employ of this company, is the greatest authority on maize in America. His demonstration work has resulted in an increased yield of three bushels per acre throughout the State, and is estimated at a value of thirty million dollars.

South African sportsmen will be interested to learn from *Nature* that the silver medal of the Zoological Society has been conferred on Major J. Stevenson-Hamilton, Game Warden of the Transvaal, in recognition of his valuable services in connection with the King's African collection.

The *Agricultural Gazette* has an instructive note on the productivity of wheat. Mr. W. R. Elgar, a member of the Canterbury Farmers' Club, has raised a crop of wheat which realized £1666. 7s. 3d., without the value of the straw, from the produce of a quarter of seed (480 lb. = 8 bushels), which he purchased two years ago at a guinea a bushel (60 lb.). The wheat is a new variety brought out by the Cambridge University School of Agriculture, and Mr. Elgar purchased in 1910 a quarter (480 lb.) of the seed for £8. 8s. The first year he had a crop of 43 quarters 5 bushels. Planting the whole of this last season, he had a total crop of 770 quarters (6160 bushels), which he has now sold for the splendid price just stated.

The *Journal of the Royal Society of Arts* states that the Provincial Government of New Brunswick is completing arrangements for placing upwards of 1000 settlers upon ready-made farms in that Province. The settlers will reside in well-developed districts, and will be provided with suitable dwellings and out-buildings. To bring this proposition into prominence in England a series of cinematograph films are being prepared showing farm and orchard life in New Brunswich, and the Government are sending out a number of qualified lecturers into the country districts to give information and explanations. It is believed that this plan will greatly assist the Government in getting the right class of settler for their Province. Why should not the Provincial Councils of South Africa emulate their brethren in New Brunswick? Land settlement may be a Union problem, but the interest, advice, and sympathetic support of Provincial Councils would surely be of the highest practical value.

In the *Journal of the Department of Agriculture of Victoria* Professor Alfred J. Ewart, of Melbourne University, writes "On Wattles and Wattle-bark." The wattle belongs to the great genus of acacias, of which out of a total of 767 species known to science, 417 are native to Australia, 112 to Africa, and 234 grow in other countries. The Professor says: "Hence there would be no valid cause of objection if any other country—South Africa, for instance—were to adopt the wattle as its national flower. As a matter of fact, botanical considerations usually play little part in the adoption of national flowers. There is, for instance, no special botanical reason why the rose should be the national flower of England, or the lily the national flower of France; while, in the case of Scotland, the national flower a botanist would have selected would probably have been the heather."

The *Journal of the Board of Agriculture* has an interesting account of pig insurance clubs. There are in England and Wales more than a thousand co-operative societies for the mutual insurance of pigs, generally known as pig clubs. Almost all of these pig clubs have been started spontaneously by working men without any help or impetus from outside. It appears that a well-managed village club in a healthy locality may reckon on an average death-rate of not more than 4 per cent. per annum; and that to pay on pigs that die an average sum of £2. 10s. requires an average net income from insurance contributions of 2s. per pig per annum.

Sugar-cane in South Africa.

By HERBERT J. CHOLES, F.S.S., Department of Agriculture.

I have crowned thee with a shooting sugar-cane, so that thou shalt not be averse to me.
—Atharva Veda.*

THE history of the evolution of the world's sugar industry constitutes one of the most interesting and notable romances that any industry might be expected to afford. From its exalted place in the temples of antiquity, where, burned by reverend hands in golden censers, it was offered up as a worthy incense to the gods; from the jewelled casket where it lay enshrined, jealously guarded as a fit and acceptable offering to any sovereign; from the most distinguished position which it occupied in the list of rare and costly luxuries of those remote days, sugar has gradually extended its dominion over the civilized world, increasing in potency with the centuries, until it is now no longer an offering simply worthy of the gods, a fitting gift for kings, an eagerly sought luxury of the favoured few, but one of the greatest necessities in the daily life of civilized man. Indeed, it almost contests with wheat the proud position of being the most widely consumed article of food of modern times, as Mr. H. W. Schneider† has recently shown. With the extension of its use its potency as a factor in the economics of the world has steadily increased. It has even set foot within the domain of politics, under the guidance of the great Napoleon, whose ingenious mind was quick to perceive its strength as a weapon with which indirectly to crush the England which he was unable to overcome by the force and strategies of ordinary warfare. And since his turbulent day it has been discussed and debated upon in the councils of all the great realms of Europe, whose statesmen have from time to time been obliged to concern themselves with the fiscal situations which it has tended to create and with its effect upon the development of their own sugar resources and trade; whilst on occasion they have met together in international council at Brussels and formed compacts for counteracting the effects of the artificial conditions first set in operation by Napoleon. Since his day the beet sugar industry which he sought to establish, and the cane sugar industry which thereby he sought to paralyse, have both prospered, until now the former finds a place in Germany, Austria-Hungary, France, Russia, Belgium, United States of America, and—on a small scale, the industry having only recently been introduced—in the United Kingdom. which countries collectively produced 6,801,000 tons in 1911-12; whilst the sugar-cane is cultivated in India, the Straits Settlements and Cochin China. China, Japan and Formosa, the Philippines, Java, Spain, the United States of America, Mexico, Cuba, San Domingo, Porto Rico, the British West Indies, the French Antilles, St. Croix, Guatemala, Salvador, Honduras, British Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, British Guiana, Dutch Guiana, Ecuador, Peru, Bolivia, Brazil, Argentina, Paraguay, Maderia, the

* The fourth book of the Vedas, the ancient scriptures of the Brahman religion.
† *Union Agricultural Journal*, Vol. IV, No. 2.

Canary Islands, Angola, Liberia, Egypt, Mozambique, Natal, Mauritius, Reunion, Australia, the Hawaiian Islands, the Fiji Islands, and Tahiti.* The sugar-cane, in fact, succeeds in almost all tropical and sub-tropical countries. The production of cane sugar in 1911-12 has been estimated by Willett and Gray at 9,001,488 long tons.

THE INDUSTRY IN NATAL.

In the Union of South Africa the sugar-cane is cultivated for sugar almost exclusively in Natal, although the industry has potentialities in other parts of the Union—notably on the low veld of the Eastern Transvaal.

In Natal the production of sugar is one of the most important—if not the most important—of all the industries in that Province, whether connected with the land or otherwise, whilst it occupies a prominent place among the agricultural industries of the Union. In 1912 it put on the market some 100,000 long tons of sugar. There were over thirty mills at work, besides a large refinery, employing some 8000 persons.

In the early days of settlement a variety of cane was noticed growing about the kraals of the native chiefs, the Zulus calling it *umoba*, which would seem to show that even before the advent of the white man sugar-cane was growing in Natal. It is believed that the early settlers brought this cane into cultivation, and that the variety now known to planters as "Green Natal" is its lineal descendant. Mr. J. Medley Wood, the Director of the Natal Botanic Gardens, who countenances this view, states that the native *umoba* was cultivated by Morewood in 1852, and that he has not been able to trace any other origin for Green Natal. On the other hand, Mr. Wm. Campbell, writing in Davis' *Almanac* of 1874, suggested the possibility of another variety having descended from the indigenous cane. "China Cane," he writes, "is now universally used in land that will not bear other cane well. Whether it is the real China cane is a moot point. Some say it was in the country many years ago, long before cane planting was thought of." However, the fact remains that the first recorded attempt of the European in Natal to grow sugar-cane for industrial purposes was in the early days of settlement.

In his "History of Natal," written in 1850, Holden wrote:—"Sugar is now beginning to attract attention, and it is thought it may be grown advantageously. One gentleman has planted several acres. . . . Two years ago (i.e. in 1848) I purchased a few plants, which were brought to this place from the Isle of Bourbon. I planted them in two different situations; one failed, the other brought forth abundantly, producing canes 6 feet long and 6 inches in circumference." The gentleman referred to by the historian was Mr. Morewood, of Compensation Flats, on the Umhlali, 35 miles north of Durban; and it was to him that the honour of founding the sugar industry was ascribed by the early planters. Mr. David Don remarks†:—"Mr. Holden's dates are not very precise, but we gather that the Compensation plantation was begun in 1849, and that Mr. Morewood's *first crop* was reaped in 1851; the implements employed in the manufacture being a pair of wooden rollers, hewn from an old mast, for crushing

* H. C. Prinsen Geerligs: "The World's Cane Sugar Industry."

† Official Handbook of the Cape and South Africa (J. C. Juta & Co., Capetown, 1893).

the canes, and an ordinary Kaffir cooking pot, of about three gallons capacity, for boiling the juice. Thus was obtained the first sample of indigenous sugar in Natal."

Mr. A. N. Pearson (sometime Director of Agriculture in Natal) records that, according to Mr. Mack, of Isipingo, 15 miles south of Durban, three of the settlers in that district, namely, Messrs. Platt, Burket, and himself, in 1852 sent a cart and oxen to Compensation Flats to obtain cuttings from Mr. Morewood, and obtained from him four varieties, named Bourbon Yellow, Purple, Ribbon, and Green Natal. They themselves gave the name to the latter variety. They paid £3 per 1000 for these cuttings, and brought away three or four thousand. Within a short space of time the Isipingo Flats became an important centre of the new industry, and in 1858 there were in Durban County alone twelve sugar mills and 1490 acres of land under cane. In Victoria County there were four or five mills only, although the average acreage of cane per mill was greater than in the case of Durban County. Further south, too, plantations and one or two mills were started at Umzinto and near the mouth of the Umkomaas.

As has already been indicated, the early machinery used for the extraction of the juice was very primitive—Morewood's rollers having been made out of a ship's mast—yet it served its purpose, and was soon superseded by steam-driven machinery. Geo. Russell, in his "History of Old Durban" (written in 1856), states that H. Milner and J. B. Miller in the year 1855 "started new machinery to demonstrate the conversion of cane juice into sugar by steam." Naturally the introduction of such machinery was a notable event in the history of the young Colony, and the report of the day ran as follows:—"The beautiful little steam engine (the first introduced into Natal) and the wonder-working centrifugal machine displayed their powers to perfection and excited the delighted surprise of all present. A quantity of thick, dark-coloured syrup was poured into the inner perforated cylinder of the centrifugal, and in exactly four minutes after the revolutions commenced (of which there were 1700 every minute) the syrup was converted into a beautiful sample of bright, dry, yellow, crystallized sugar equal to the finest qualities of imported from Mauritius. In seven minutes the same syrup was converted into sugar of still finer quality, almost white in colour, and far superior to the imported article. Several quantities were sold, the prices averaging 30s. per cwt."

As was only natural, the river flats were the favourite land for cultivation in the early days, and for convenience of haulage of the cane the mills were built on the same level. The results were not happy for the planters, for the cane was liable to injury from frost and the cane-fields and the mills were in frequent danger of being flooded out. In 1856, according to Mr. Don, there was a great flood of the Umgeni, when the mill at Springfield was almost totally destroyed. The river rose 28 feet "and not only submerged the Springfield cane-fields, but rushed through the factory to a depth of 9 feet, and, among other havoc, carried the heavy battery of boiling pans clean out of the masonry. . . . On the same occasion another sugar mill was similarly destroyed on the banks of the Umhloti."

The lack of knowledge of the technicalities of the industry by the early planters led to innumerable difficulties. At first little was known about the cultivation of the cane, and practically nothing about the

processes of sugar manufacture. And besides these difficulties the planters were troubled by the financial aspect. Mr. William Campbell, writing in 1874, said:—"This was a poor country and without credit, at least for purposes of agriculture. The little money there was was

After Blair Sugar-cane (*Saccharum officinarum*).

under the control of a few, who gave or withheld as seemed to suit themselves—12 per cent to 14 per cent. per annum was the rate of discount at the banks; 7½ per cent. to the merchant for his name to discountable paper; 10 per cent. commission for selling sugar; sugar

sold at four months' credit; goods bought at an advance of 5 per cent. to 10 per cent. on market price, depending on the kind of dinner the agent had overnight, for planters were bound to purchase from him at whatever price his lordship might condescend to fix." And a few years later the planters suffered from the opposite evil—a glut of money. The banks, anxious to invest, urged the planters to launch out in big ventures, with the result that many went beyond their strength and several were ruined when the reaction set in. In many cases, too, estates changed hands, passing to mortgagees who became absentee proprietors. Mr. Campbell thus pictures the state of affairs:—"A creditor, being mortgagee, or company or other, insists upon all sugar going to one particular market no matter whether it be the worst; whether to England, the Cape, or elsewhere, it must be sent where the mortgagee or the director or his agent may realize a commission on the sale. It frequently happens also that the mortgagee or the director or his agent is troubled with the love of meddling, and writes to the manager, or goes on to the estate and tells him what to do, when to crush, when to plant, and gives directions generally as to what is to be done; and the proprietor may obey to his loss any such directions, being fast bound by the creditor."

In spite of all these obstacles the industry grew steadily, as it was bound to, until it reached such dimensions that the question of labour supply became a serious problem—so serious, indeed, that unless a solution could be found the industry would be threatened with extinction. Although the country was teeming with blacks these did not constitute the steady and reliable labour for which the sugar industry called. The Kaffir is not a worker in the real sense of the word. He is able-bodied, hardy, and enduring, but he has not inherited the instincts of labour, and nothing short of compulsion, physical or economical, would make him devote himself to steady work. This was the position the early sugar planters found themselves in nine years after Mr. Morewood planted the first field of sugar-cane in Natal.

The difficulty was overcome by the Government of the day, who, in 1859, legalized the importation of coolies from India. The first shipment arrived in 1860. Six years later there were 5600 Indians, men and women, in the Colony.

Notwithstanding the many difficulties which from time to time confronted the planters—fire, flood, frost, lack of knowledge, lack of money and glut of money, insufficient labour, and financial crises—they persevered and succeeded in building up what is to-day one of the foremost agricultural industries in South Africa. In 1864 it made an important advance, the output of that year being "three or four times that of any previous year." In 1867 a duty of 3s. 6d. per cwt. was imposed on imported sugar. In 1868 rum began to be exported. In 1869 there were 15,892 acres of land under cane, and in that year 7823 tons of sugar and 34,778 gallons of rum were produced. (Mr. Thomas Reynolds was among the first, if not the first, we learn from Mr. Don, to recognize the distillery as a necessary complement to the sugar factory.) The opening of the Kimberley diamond fields in 1870-1 gave a general stimulus to South Africa, and so enlarged the market for South African sugar that, whereas in 1870 only three factories possessed vacuum pans, by 1873 nine more had installed them. A few years later a number of Mauritius planters, together with

trained artisans, settled in Natal, introducing their expert knowledge into the local industry. At the same time (in 1877-78) there was erected the first large sugar mill in the Colony, namely, the Natal Central Company's factory at Mount Edgecombe. This was built under the supervision of Mr. Alfred Dumat from Mauritius and was fitted up with machinery also from that country. Although the machinery was not new it was up to date and in advance of anything hitherto seen in Natal. This mill had a capacity of 30 tons of sugar a day, or 5000 tons in a season. The idea was that it should be a central factory, but from the first the company had themselves to grow cane in order to supplement the inadequate supply from the planters. With the growing demands of the South African market and the increasing facilities of transport provided by the growth of the railways the industry progressed steadily, and by 1892 there were 26,000 acres of land under cane and the output of crystallized sugar amounted to approximately 18,000 tons.

At the same time the number of small factories diminished, their place being taken by a fewer large factories—the latter effecting a more thorough extraction and a smaller working cost per ton of sugar.

The following statement reflects the growth of the industry since 1894:—

Year.	Sugar Produced. Long Tons.
1894	19,369
1895	20,508
1896	20,651
1897	20,245
1898	29,186
1900	16,689*
1901	36,662
1902	21,095
1903	33,944
1904	19,238
1905	26,158
1906	21,479
1907	24,223
1908	31,999
1909	77,491
1910	84,437
1911	92,000
1912	100,000 (approximately).

During recent years the Government of Natal did much to assist the growth of the industry. In 1905—during the Hon. W. F. Clayton's régime as Minister of Agriculture—portions of Zululand suitable for sugar growing were thrown open for European settlement. In respect of a considerable area of these lands the Government entered into an agreement with Sir Liege Hulett to erect central sugar factories; one of these was erected at Amatikulu and a second has been constructed at Umfolosi. According to the terms of the agreement the central factories must receive for crushing all the cane supplied by settlers within a certain radius. For the settlers' part,

* Effect of the Boer war.

the terms of the lease of their farms included the planting of certain minimum areas (according to the class of farm) with cane. This policy has resulted in a great impetus being given to the industry, and the stage has now practically been reached when the industry is in a position to supply the whole of the South African market for sugar and when planters must look oversea for further expansion.

THE CANE PLANT AND ITS PRODUCT.

In considering the subject of sugar production, a thought that naturally arises in the inquiring mind is: What is sugar? Of what is it constituted? How is it formed?

To gain an insight into this interesting subject we must know that plants form and store up for future use against times of shortage of food supplies what are termed "carbohydrates"—compounds—that is, made up of carbon, and hydrogen and oxygen, the two constituents of water. These compounds are elaborated in the leaves of the plant, and are found in various forms. Now, from the botanical point of view, starch may be said to be the simplest carbohydrate, because all the known members of the series of such compounds can be expressed as derivatives from starch (Watt).

Some plants store their reserves of carbohydrates in the form of starch, others as sugar. Of the former, the cereals and potatoes are well-known representatives, although in the case of maize we have both starch (in the grain) and sugar (in the stalk); in fact, commercial sugar has actually been manufactured from the juice of the maize stalk, and is considered by some authorities to be a practical industrial proposition. Of sugar-storing plants the sugar-cane and the sugar-beet are the most notable, although there are a number of others whose juice can be made to yield commercial sugar, whilst a large number, including many of our cultivated fruits store up sugar in smaller and varying quantities.

The sugar-cane, botanically known as *Saccharum officinarum*, is a member of a group of grasses belonging to the family *Graminæ*, of the tribe *Andropogoneæ*. These grasses are described as tall plants with compound, often dense, panicles, covered with long, silky hairs. The spikelets are very small, and there are no awns to the valves, as in the majority of the tribe. The sugar-cane plant is of tall, graceful, luxuriant growth, attaining a height of 6 to 20 feet or more. Several grass-like stems spring in a clump from the one set of roots, and each bears long, grasslike leaves. The plant terminates in a feathery plume or seed-head, known by the planters as the "arrow." The stems are often as thick as medium-sized bamboos, and present rather the same appearance owing to their "joints" or knots. Industrially the plant is propagated from cuttings, but for the purpose of producing new varieties the seeds are planted.

VARIETIES AND IMPROVEMENT OF CANES.

Of all the numerous plants that have been brought under cultivation and improved by man for the furnishing of necessities and luxuries, none comprises such a wonderful number of varieties as the sugar-cane. Even if we divide these varieties into local kinds (that is to say, those known only in the country of their origin) and general or well-known kinds—varieties which, because of their comparative

excellence, or their recent creation by man, and for other reasons, are to be found in a number of the more important sugar-producing countries—and consider simply the latter group, even then we find that this class comprises some hundreds of varieties. It is only when we come to consider the sugar industry of each country separately that our heavy list becomes really manageable, for we find that, generally speaking, each sugar-producing country has its own favourite canes, canes better suited than others to its peculiar conditions. And the reason for this geographical distribution of varieties is not far to seek. It is simply due to the fact, recognized by botanists, that no matter how firmly fixed the characters of any given variety of plant may be in the country in which they have been evolved or modified, they are always subject to modification in new conditions of climate and soil. This is very noticeable, for example, in the cases of tobacco and the soybean; and it is evident, too, in regard to maize. When the attempt is made to establish an economic plant from elsewhere in entirely new surroundings and conditions, the possibility of variation from type has always to be taken into consideration, and where this occurs the creation or evolution of new types becomes involved—types better fitted to local conditions than the forms from which they spring, although in the early stages they may not be of as high an economic value. Then it remains to improve the plant and fix the desirable variations.

We have the same tendency with the sugar-cane as may exist in any other plant of economic value, and it is chiefly for this reason that each sugar-producing country has its own peculiar varieties. Some of these varieties may be found in other countries also, but the probability is that they do not occupy the same place in regard to importance, whilst it is extremely likely that some slight variation at least has taken place since its importation.

An interesting instance of this is given by Watt: "Several writers affirm," he says, "that Bourbon cane was originally obtained from the coast of Malabar. Assuming this to be correct . . . the translation of the Malabar cane to the insular conditions of its new home and to the improved systems of cultivation it there received, resulted ultimately in the production of what is known as Bourbon cane. A few years' return of that improved state sufficed, however, in India to reduce it to what is perhaps a worse condition than its original." This case is an instance of both improvement and deterioration—improvement by transference to new conditions, together with improved methods of cultivation, deterioration by retransference to earlier conditions. And in this way it proves the value of experimental work, not only with new local varieties, but with foreign kinds of cane as well, experiments which may now and then conceivably result in the discovery of a type exhibiting excellent qualities in its new environment.

Coming nearer home, we find a reference to our Natal Uba cane in the *Antigua Standard* of the 2nd May, 1903, in a communication from Mr. George J. Goodwin. He says: "In reference to African canes reaped by me this year, I herewith give you all figures at my disposal. The 'Uba' I had abandoned altogether since last year, as it was such a small, hard, dry cane which would not let go its trash; it cost too much to cut, and was then far below our present standard canes." Whilst this variety is not by any means considered an ideal

cane by Natal millers, yet it possesses such advantages over other canes tried in South Africa that it is the most extensively cultivated type in Natal, and is considered to be the most suitable cane for our conditions so far as our present knowledge goes. Yet in Antigua we find it discarded in favour of Green Natal and Lousier, in a test of South African canes.

We have referred to the variety of cane known as "Green Natal," which is supposed to be indigenous. Besides this, there have been many imported varieties of cane introduced. A variety known as China cane was at one time extensively grown, but it had to be discarded, as it succumbed to a species of smut (*Ustilago sacchari*). Among other varieties tried may be mentioned Lousier, Fotiogo, Bois-rouge, Imperial, Tamarind, and Belleongete, said to be from Mauritius; Ribbon, Bourbon Yellow, and Bourbon Purple, probably from Bourbon; also White Queen, Port Mackay, Gold Dust (white and red), Rose Bamboo, and Striped Tanna. None of these, however, are now generally cultivated; almost everywhere they have been ousted by the Uba variety. The Striped Tanna, however, is a cane of luxuriant growth, and would probably figure prominently among the best varieties produced here under irrigation. Where irrigation is practised, the field of the planter in the matter of choice of suitable varieties of canes—that is to say, so far, at least, as richness in sugar and stooling qualities are concerned—would be considerably enlarged, but, dependent upon the ordinary rainfall, which, as we shall see, amounts in Natal to but 40 inches out of a maximum of 100 inches for maximum development, the scope of the planter is necessarily limited, and he has to fall back upon the Uba variety, with its advantages from the planters' point of view and its disadvantages from the view point of the millowner.

It is generally believed in Natal that the Uba variety derived its present name from the only letters remaining legible on a damaged label attached to the first cuttings received in the Colony. In sugar-cane literature, however, the Uba or Yuba is a recognized variety, and in this connection the following letter addressed to Mr. J. Burtt-Davy, Government Agrostologist and Botanist, by Mr. Noel Deerr, sugar technologist at the experimental station of the Hawaiian Sugar Planters' Association, will be read with interest:—

"We have for acknowledgement Mr. J. Burtt-Davy's letter (2083) of the 1st December, 1909, in reference to the Uba cane.

"This cane is referred to in the literature of the sugar-cane since at least 1869, but we have nowhere come across any detailed history of it.

"1. Dr. Stubbs describes the cane as under: 'No. 29, Japanese or Zwinga from Japan. Introduced by Commissioner Le Duc. It is *sui generis*, and may possibly be a different species of cane. It is extremely hardy, enormously productive under good cultivation, exceedingly woody, difficult to crush, and of moderate sugar content. Proper cultivation might eliminate some of the objectionable qualities. Its origin is unknown, as no mention of this variety occurs in any writings on sugar-cane, and is perhaps not cultivated anywhere else than in Japan.'

"2. Mr. John Dymond states that the Uba cane is the same as the Zwinga or Japanese cane, but does not go into detail. He mentions Brazil as the country whence introduced.

"3. The cane Uba was introduced into Mauritius from Brazil in 1869.

"4. Elsewhere this cane is called Yuba.

"5. On introduction into Natal the label attached to the cane was partly undecipherable, only the last three letters being legible. This is supposed to be the origin of the name Uba, but as the name Yuba and Uba exist as far back as 1869, at most only one letter was lost.

"6. This cane also forms the staple cane of Madeira.

"7. We have no knowledge how this cane reached Brazil or Madeira."

According to Mr. Medley Wood's opinion, this cane was introduced into Natal by Governor Sir Charles Mitchell, who, on returning from a visit to India in 1884-85, brought with him two cases of canes, only three of which reached Natal alive. These were propagated by Mr. Medley Wood, and the resulting plants were given to Mr. Anthony Wilkinson. This cane was, however, also introduced in quantity by Mr. De Pass, of the Reunion Estate.

"From a milling point of view this cane is undesirable; it is thin, tough, wiry, and fibrous, and the juice, it is said, needs special care in the treatment; mill managers say that from 10 to 30 per cent. more mill-power is required for this cane than for any other variety. But the planters like it, since it endures the uncertainty of the Natal climate better than any other variety yet tried; it is hardy, bears frost and drought, stools prolifically, and recovers readily from locust attacks, is subject to no fungous pests, and but little damaged by white ants and the borer." (Pearson.)

It is, furthermore, a better cane from a ratooning point of view, yielding satisfactory ratoons five or six times as compared with three ratoons compared with other varieties. The first ratoon crop of the Uba cane is stated by some planters to yield better results than the plant-cane crop itself. This variety of cane also stools well, producing up to twenty canes per stool.

A number of varieties of cane have from time to time been introduced from the West Indies, British Guiana, Mauritius, Queensland, and Honolulu, the Department of Agriculture having co-operated with the planters for their importation. A leading part has been taken in this matter in the past by the Inanda Agricultural Association.

The following analyses of Uba and certain imported West Indian canes made about the year 1905 are given by Pearson:—

UBA CANE.

	Average.	*Maximum.*
Total solids in juice (per cent.)	20.32	22.79
Sucrose (per cent.)	18.61	20.79
Glucose (per cent.)	0.18	0.27
Non-sugars (per cent.)	1.53	1.73
Glucose ratio	1.00	1.30
Purity	91.60	91.20
Per cent. of juice in cane	84.28	82.30
Per cent. of fibre in cane	15.72	17.70

The above analyses show a large proportion of fibre in the cane, but indicate no inferiority in the juice; in fact, the quality of the

juice, so far as disclosed by analysis, would not be readily surpassed anywhere (Pearson).

WEST INDIAN CANES.

	B.109	*D*.95	*B*.15
Total solids in juice (per cent.) ...	15.31	17.04	16.78
Sucrose (per cent.)	12.68	15.83	15.19
Glucose (per cent.)	1.78	0.28	0.37
Non-sugars (per cent.)...	0.85	0.93	1.22
Glucose ratio	14.17	1.78	2.46
Purity	82.80	92.90	90.60

Mr. Pearson remarks: "The samples were gathered unseasonably, and the juices were dilute, but the purity and glucose ratio of the last two samples were good. In fact, the analyses, generally, show that, as far as quality is concerned, the soils and climate of Natal admit of cane being grown here as elsewhere."

Variety Experiments.—Perhaps the most systematic work in connection with the production and testing of new varieties of canes has been performed by the Imperial Department of Agriculture for the West Indies. Here, year after year, experiments are continued, and the results are published of each season's work. The object which is steadily held in view is to obtain such varieties as will best suit the varying soil and climatic conditions existing in the different districts of the island of Barbados. To this end numbers of new canes are raised from seed annually. Seeds of the sugar cane are sown in boxes towards the end of November or the beginning of December in each year. As soon as the little plants are sufficiently advanced they are pricked out into pots, and when they are about ten or twelve inches high they are planted—usually in the month of May—in a field arranged for irrigation, so that they may be grown to maturity by the May of the following year. In a year's time those varieties which from their field characters are considered good enough for reproduction are cut, weighed, crushed, and the juice is analysed, but only the stools from those canes which contain fairly rich and pure juice are replanted. The stools of the canes selected are taken up, divided in half, and planted where they can be irrigated; care is also taken to label each variety. During the following December the canes from these stools are made into cuttings and replanted. From that time onwards each variety is annually propagated and multiplied in the usual manner and grown in competition with the white transparent, the standard variety. If the results of the new cane when grown in similar conditions as the standard cane justify it, the new canes are cultivated on the various experimental plots in the black and red soil districts until they are ultimately rejected or cuttings are supplied to the planters with the recommendation to try them on a small scale, and, if the results justify it, gradually to increase the areas under cultivation.

In Natal the history of experimental work is not as old as that of the West Indies. Nevertheless, some useful investigations are being made at the sub-tropical experiment station at Winkel Spruit, on the south coast. Many imported varieties are being tried in competition with what may be considered to be the Natal standard cane—the Uba variety—but in many cases it is found that, although these canes may be of superior milling quality, being thick and easily

crushed, nevertheless they do not stool as freely, are comparatively shallow-rooted (a serious objection in a country where drought may at any time threaten and where irrigation is not practised), and do not offer as good a resistance against the strong winds which are often experienced along the Natal coast, whilst in many cases they are not as good ratooners as the Uba. One of the directions, therefore, in which experimental work will be carried on in the future at Winkel Spruit is in the hybridizing of imported canes possessing desirable milling qualities with the Uba in order to combine the virtues of both types in a new cane which will meet with the approval of both the planter and the sugar manufacturer.

Mr. Sawer writes: "The so-called 'Inanda' varieties, which have been under trial in Natal for some ten years, have now been examined from the standpoints of both planter and millowner, and the double test severely limits those worthy of a general recommendation. Of these, the first place should probably be given to the Demerara seedling D.109, which is a heavy cropper, an excellent ratooner, and affords a juice rich in sucrose and of high purity. The canes are, however, less stout than those of some of the varieties, and show a slight tendency to a semi-erect growth. D.95, a stouter cane of good length and erect growth, gives a lighter crop in the test plots, but also affords a juice of excellent composition, and should hold second place to the above. D.74, in which much interest has been taken by local planters, is certainly an excellent field type, but would less commend itself to the sugar chemist. The remaining varieties, though offering individual features of merit, come short of the desired standard on application of a vigorous examination."

CLIMATIC REQUIREMENTS.

Climatic influences exert a very pronounced effect upon the commercial value of all sugar-secreting plants. We find that sugar-cane, for instance, attains to its best growth in warm moist climates, for which reason it is to be seen to greatest perfection on islands and along sea coasts within the tropics and sub-tropics. Its luxuriant growth in such regions, and in proximity thus to the sea, has been ascribed by many to the salinity of the atmosphere, but it is more likely, as has been pointed out by Newlands, that the explanation is to be found in the considerable quantities of moisture borne into the plantations by the sea breezes. This, supplemented to a heavy rainfall, together with the tropical sun, serves to ensure an unchecked and rapid development of the plant. Another reason why tropical regions are more favourable to the growth of the sugar-cane for the purposes of sugar manufacture is the absence of heavy frosts which characterizes them. The sugar-cane is arrested in its development by cold in any degree, whilst frosts are positively injurious, not only sometimes causing the canes to burst, but also affecting the juice to such an extent that it can no longer be induced to crystallize, unless cutting and crushing can be performed before a thaw occurs. On the other hand, sugar-cane is successfully grown in districts afflicted by frosts for stock-feeding purposes, and is thus to be found in various parts of South Africa outside what may be termed the sugar areas, though not to the extent it might be.

The tables in the Appendix* afford a tolerably good idea of the

* See end of present instalment.

rainfall and temperature conditions in which the sugar-cane is grown in Natal. The figures are based upon returns for six years from the following five centres, viz., Stanger, Verulam, Durban, Winkel Spruit, and Umzinto. I have selected these stations as most likely to exemplify the conditions which it is desired to illustrate. The figures given in these tables show that in Natal the sugar-cane is grown with an annual rainfall of approximately 40 inches, as compared with a rainfall of 100 inches which the sugar-cane requires for its maximum development and which it obtains in countries enjoying a more tropical climate. Another adverse factor is the incidence of a comparatively cool winter, which retards the development of the cane and runs the crop into two years instead of one year in other countries with a more favourable climate and practically no winter.

Whilst it is true that a good rainfall is one of the essentials to a perfect growth of the plant the statement needs to be qualified. There is a period during which heavy rains may prove detrimental. This latter season comprises the period during which the canes are maturing; during the two or three months of growth, indeed, what the planter desires is hot and fairly dry weather, which is conducive to the highest degree of sweetening of the juice, resulting in a large yield of fine sugar. The vigour of the plant, however, needs to be maintained without appreciably weakening the juice. Where drought is experienced, broken up by good rains which result in new vegetation, it is a good plan—provided there is no danger of frost—to postpone cutting for a while, in order to give the cane juice an opportunity of sweetening still further. In this connection, it may be mentioned that in Natal the best time for harvesting has been found to be from August to October, since there is (normally) less rain prior to and during that period than during any other portion of the year; and dry weather, of course, brings up the sugar content of the juice. The incidence of drought immediately before cutting is, indeed, very beneficial to the crop, as, owing to the transpiration of moisture from the plant, through the leaves, accompanied by a diminishing absorption of moisture through the roots, a thickening of the saccharine contents of the cells of the plant takes place. The result is juice of considerable density and often great purity. In fact, if rain unfortunately does occur, during hot weather, just before cutting commences, the practice on many estates is to allow the canes to evaporate to some extent before passing them into the mill. Discretion must be exercised in this drying process, however, as evaporation can be carried too far, when the juice is reduced in quantity and to some extent changed in quality. It may even become strongly acid. These "burnt" canes, as they are called, exhibit yellowing leaves and an arid and scorched appearance of the stem. (Further information upon this point will be found in the section devoted to harvesting: Keeping qualities of cane.)

SOIL REQUIREMENTS.

Sugar-cane plantations are to be found practically from end to end of the Natal coast, as well as up into Zululand and through a tolerably wide range of soils. These include sands—grey and red—light loams, and chocolate loams, sandy clays of all degrees of texture, grey alluvials and black alluvials. A number of these differing soils may sometimes be found within the bounds of a single estate, and several even in one cane field. The prevailing soil, however, is a red

or chocolate ferruginous sandy loam of light texture, and easily worked after it has once been broken up. When first cleared of bush this class of soil is often very fertile and has been known to give, in good seasons, yields of four and five tons of sugar crystals per acre from the plant-canes.

The great desideratum, of course, is a soil that, being not too clayey on the one hand, and containing not too large a percentage of sand on the other hand, will admit air freely and absorb moisture readily and hold it, yet at the same time overlying a sub-soil of such a nature as to offer no danger of waterlogging. Too great a proportion of clay will render a soil heavy and difficult to work; it will not admit of easy aeration, nor will it absorb moisture readily, but, having absorbed it, will hold it in such quantities as to be detrimental to the satisfactory growth of the plant.

Again, deep black moulds, so much sought after for many another crop, should, if possible, be avoided. They certainly tend to produce exuberant plants, but the juice is neither plentiful nor rich.

Some of the very best sugar is produced on limestone soils.

An excessively saline condition, which is liable to be found on flats along a sea coast, is also detrimental to sugar-cane, impregnating the juice with salt to such an extent as to cause much trouble and expense in the manufacture of the sugar. In such cases, earthen dykes or bunds should be thrown up to protect the fields from the incursions of the sea. In a couple of seasons the salt in the soil will be washed out sufficiently by the rains, and the process is hastened if maize is planted for two or three years before cane is put down.

In Natal the early planters met with other troubles on the alluvial flats, which are, in many cases, protected by natural means from the sea. As has been stated in the historical notes, cane was planted exclusively on these flats, but although in some instances fields of this nature have been in continuous cultivation for over forty years and still yield well, the danger of loss from the flooding of the rivers, frost, etc., gradually brought the cane-fields up the hill-sides, and even on the steeper slopes where only hand labour can be made use of cane is now grown.

According to Mr. Wm. Campbell, "tambootie" grass land is excellent for cane.

PREPARATION OF THE SOIL.

Natural bush is the predominant feature along the Natal coast, and its presence on these sandy slopes bespeaks a fertile soil rich in moisture-holding humus. It is these bush-clad slopes which have been cleared and are still giving way before the ever-advancing sugar-cane. In the case of these newly cleared lands, ploughing is not really necessary, nor is it altogether a practical proposition owing to the presence of the larger tree and wild banana stumps, which are difficult to remove and are generally left to rot. The soil is, however, in fairly good condition after clearing, and the grubbing of holes for the cane cuttings is all that is required.

Grass land, on the other hand, requires to be broken up, and it must then be allowed to lie for some time, being later cross-ploughed and harrowed.

The late Mr. Anthony Wilkinson, one of the pioneers of the Natal sugar industry, has described * the system of preparation of

* *Natal Agricultural Journal*, 1904.

the land adopted by him. The whole of the estate is marked off into acre divisions by the simple expedient of planting banana trees at points 70 yards apart each way. This ingenious system of beaconing is for the purpose of facilitating the allotment of piece-work—for, as far as possible, all is piece-work on a sugar estate. Wherever practicable, the land is ploughed. On the Natal plantations, generally, the hoe is preferred, owing, probably, to the influence of the Mauritian systems. Ploughing entails somewhat more supervision, but Mr. Wilkinson holds it to be considerably cheaper. In Mauritius labour costs much less than in Natal. Nearly all the ploughing on Mr. Wilkinson's estate, it may be added, is done with hillside ploughs.

On Mr. W. G. Armstrong's estates at Verulam the land is ploughed after the final ratoon crop is cut, and then left fallow for two or three months. It is then harrowed, cross-ploughed, harrowed again, and furrowed for planting.

On the Tongaat estates the land is simply ploughed, cross-ploughed, harrowed, and furrowed.

APPENDIX.

The following are the rainfall and temperature tables referred to under "Climatic Requirements":—

RAINFALL AND TEMPERATURE OF NATAL COAST.

AS EXEMPLIFIED BY THE RETURNS OF SIX YEARS FROM FIVE STATIONS.

Table I.—Showing the Average Rainfall at the undermentioned Centres for each month of the year, together with the highest and lowest falls in the series from which the averages are calculated.

Month.	Stanger.			Verulam.			Durban.			Winkel Spruit.			Umzinto.		
	Average Fall.	Highest.	Lowest.	Average Fall.	Highest.	Lowest.	Average Fall.	Highest.	Lowest.	Average Fall.	Highest.	Lowest.	Average Fall.	Highest.	Lowest.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan...	4·46	6·60	2·87	3·84	5·99	1·98	3·41	4·61	1·91	3·01	4·79	1·15	3·02	5·23	1·93
Feb...	5·26	5·64	4·14	5·52	6·87	2·45	5·36	6·31	3·27	6·38	9·27	4·06	5·87	12·92	4·21
March	3·83	4·65	2·36	2·98	3·92	2·06	3·85	4·87	1·96	3·71	4·61	2·17	4·12	8·75	2·46
April .	2·93	6·83	0·52	3·81	9·78	0·11	5·38	15·43	0·65	4·64	13·32	0·10	3·80	14·22	0·19
May ..	2·18	5·07	0·44	3·58	12·43	0·18	1·66	5·82	0·37	2·16	6·45	0·12	3·20	10·60	Nil
June ..	0·95	1·82	0·41	0·35	0·38	0·15	2·71	11·12	0·52	3·82	14·11	0·22	0·72	2·54	0·06
July ..	0·74	1·31	0·25	0·55	1·61	0·06	0·89	1·89	0·16	0·92	1·77	0·03	0·48	1·39	0·02
Aug...	0·66	1·71	Nil	0·49	1·58	Nil	0·61	1·80	0·01	0·52	1·65	Nil	0·40	1·09	Nil
Sept...	3·69	6·86	1·46	2·83	5·27	0·37	2·56	6·21	0·58	3·75	6·94	2·12	3·82	7·74	1·88
Oct. ..	4·00	6·58	2·27	3·97	6·15	1·83	4·93	8·11	2·11	5·42	9·09	2·39	6·25	11·73	2·17
Nov...	6·93	10·86	5·55	5·54	9·37	1·97	4·59	7·69	3·19	6·37	10·67	2·93	5·43	9·59	2·62
Dec...	5·34	9·77	3·43	4·37	6·19	3·32	5·32	8·07	3·01	4·97	7·93	2·37	4·44	8·85	1·68
The Year..	40·97	10·86	Nil	37·83	12·43	Nil	41·27	15·43	0·01	45·67	13·32	Nil	41·56	14·22	Nil

Average annual rainfall of the above five stations ... ... 41·46 inches.

Table II.—Showing Average Number of Days in each Month on which Rain falls at the undermentioned Centres.

Month.	Stanger.	Verulam.	Durban.	Winkel Spruit.	Umzinto.	Average of Five Stations.
January	19·0	12·0	18·0	13·0	8·5	14·1
February	17·0	12·0	16·4	13·7	9·2	13·7
March	16·4	9·7	14·5	13·2	8·0	12·4
April	12·0	5·4	12·0	7·0	5·7	8·4
May	7·9	4·2	8·9	5·9	3·5	6·1
June	5·4	2·0	4·9	3·6	2·7	3·8
July	6·4	2·2	4·2	2·4	1·4	3·4
August	7·5	3·2	7·0	4·4	2·7	5·0
September	15·5	8·2	15·4	9·9	7·2	11·3
October	18·0	13·2	18·2	13·0	11·0	14·7
November	22·0	17·6	19·8	14·7	11·9	17·2
December	21·0	13·7	19·9	16·5	12·5	16·7
Total ...	168·1	103·4	159·2	117·3	82·3	126·1

Table III.—Showing Average Maximum and Minimum Temperature during each Month of the Year.

Month.	Stanger.		Verulam.		Durban.		Winkel Spruit.		Umzinto.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	°	°	°	°	°	°	°	°	°	°
January	107·0	60·0	105·0	66·4	93·2	62·3	93·0	60·0	97·2	54·4
February	100·9	59·7	100·2	62·2	90·7	61·2	88·5	60·0	*95·4	*52·0
March	98·2	55·4	96·8	59·2	88·8	60·7	88·7	58·5	91·0	52·8
April	94·9	55·5	94·0	53·5	89·0	56·0	87·4	52·7	†86·3	†56·3
May	91·5	49·7	90·0	48·0	87·4	50·0	82·7	48·7	*80·0	*46·4
June	86·7	48·0	84·4	46·5	82·4	48·7	81·2	48·3	*78·4	*44·4
July	85·9	44·2	83·5	44·2	82·0	46·8	80·5	45·0	79·0	46·5
August	96·2	46·6	96·0	45·0	93·5	47·6	95·2	45·8	87·2	49·0
September ...	97·7	48·9	95·7	51·9	88·6	52·7	89·4	50·5	†89·3	†50·5
October	100·6	50·8	87·6	51·6	87·3	53·2	85·7	49·7	‡96·5	‡52·0
November ...	103·5	53·8	102·0	55·8	88·3	56·7	89·0	53·2	†92·5	†55·5
December ...	105·4	57·7	101·7	59·7	89·0	60·2	89·7	57·9	94·9	54·7

* Three years' average only. † Four years' average only.
‡ Two years' average only.

This table, perhaps, needs a little explanation. Its object is to show not the absolutely highest and lowest monthly temperatures recorded during the period investigated but the *average* maximum and the *average* minimum month by month, in order that an idea may be gained as to the highest and lowest temperatures which may, on the whole, be expected in ordinary seasons. The next table (No. IV) shows the absolute highest and lowest monthly temperatures reached during the period studied. This, in turn, gives an idea of the ranges of temperature to which the sugar-cane has been subjected on the Natal coast.

Table IV.—Showing the Highest and Lowest Temperatures recorded during the Period under Discussion.

Month.	Stanger.		Verulam.		Durban.		Winkel Spruit.		Umzinto.		Highest and Lowest recorded.	
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.
	°	°	°	°	°	°	°	°	°	°	°	°
January ...	113	55	114	60	97·2	58·5	96	55	102	53	114	53
February ...	106	54	105	60	95·4	57·1	94	58	*99	*50	106	50
March ...	104	52	100	56	89·1	58·7	91	57	95	45	104	45
April ...	101	51	99	49	95·2	53·7	92	49	†93	†55	101	49
May ...	97	46	95	40	91·2	41·1	87	42	*85	*41	97	40
June ...	96	46	90	45	90·0	45·4	89	46	*80	*42	96	42
July ...	92	40	87	40	85·5	45·0	85	41	87	42	92	40
August ...	101	44	102	42	99·9	45·7	102	44	98	47	102	42
September...	105	42	103	48	101·1	50·6	103	47	†93	†44	105	42
October ...	102	49	102	50	96·1	52·8	99	48	‡98	‡50	103	48
November...	108	50	104	52	90·7	54·0	93	50	†96	†50	108	50
December...	111	53	106	56	90·7	56·0	94	51	100	50	111	51
The Year...	113	40	114	40	101·1	41·1	103	41	102	41	114	40

* Over three years only. † Over four years only. ‡ Over two years only.

Table V.—Showing the Average and Greatest Monthly Ranges of Temperature to which the Sugar-cane has been subjected at the undermentioned Centres over the Period investigated.

Month.	Stanger.		Verulam.		Durban.		Winkel Spruit.		Umzinto.	
	Average Range.	Greatest Range.	Average Range.	Greatest Range.	Average Range.	Greatest Range.	Average Range.	Greatest Range.	Average Range.	Greatest Range.
	°	°	°	°	°	°	°	°	°	°
January	47·0	57·0	38·6	51·0	30·9	38·0	33·0	39·0	42·8	47·0
February	41·2	50·0	38·0	44·0	29·5	34·0	28·5	34·0	*43·4	*45·0
March	42·8	51·0	37·6	40·0	28·1	37·0	30·2	34·0	38·2	50·0
April	39·4	47·0	40·5	49·0	23·0	40·8	35·7	40·0	†30·0	†38·0
May	41·8	47·0	42·0	48·0	37·4	46·2	34·0	42·0	*33·6	*35·0
June	38·7	50·0	37·9	45·0	33·7	41·2	32·9	43·0	*34·0	*37·0
July	41·7	52·0	39·3	43·0	37·2	38·7	35·5	44·0	32·5	45·0
August	49·6	54·0	51·0	57·0	45·9	52·2	49·4	55·0	38·2	49·0
September ...	48·8	63·0	43·8	55·0	35·9	50·5	38·9	54·0	†38·8	†46·0
October	49·8	52·0	46·0	52·0	34·1	42·8	36·0	48·0	‡44·5	‡45·0
November ...	49·7	58·0	46·2	48·0	31·6	35·0	35·8	37·0	†37·0	†39·0
December ...	47·7	54·0	42·0	45·0	28·8	29·7	31·8	38·0	40·2	45·0
For the Year—										
Average Range	45·0	—	41·9	—	33·0	—	35·2	—	37·8	—
Greatest Range	—	63·0	—	57·0	—	52·2	—	55·0	—	49·0

* Calculated on three years' figures only. † Calculated on four years' figures only.
‡ Calculated on two years' figures only.

(To be continued.)

Tuberculosis of Food Animals and its relation to the Public Health.

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(Continued from page 99.)

Sanitation.

Although tuberculosis occasionally occurs amongst animals living an open-air life, it is especially met with amongst those which are more or less constantly confined to stables—such, for example, as pure-bred stock and dairy cattle.

Dark, dirty, crowded, and ill-ventilated cowsheds are especially favourable to the propagation of tuberculosis, and when introduced into such premises the disease not infrequently spreads amongst the inmates with startling rapidity.

Sunlight is a great destroyer of microbic life, and it is consequently very necessary that all buildings used for housing animals—and especially does this apply to cowsheds—should be efficiently lighted by means of windows or other openings. Every part of the interior of such buildings should be clearly visible, even when all the doors are closed.

Ventilation.—There should be an abundant supply of pure air. Animals kept in badly ventilated stables become reduced in vitality, and if exposed to infection easily contract disease. Cowsheds should be thoroughly ventilated; the air in the building should not feel "stuffy" even when all the cows are housed and the doors and windows shut.

Cleanliness.—This is very important. We have already seen that the faeces (manure) of tuberculous cattle often contains living tubercle bacilli. Such manure may convey the disease to other animals, and, if it gains access to the milk, to human beings also. It is therefore very important that the cowsheds be frequently cleaned out and the manure removed.

Care should be taken to prevent soiling of the flanks and udders of milk cows with manure, and where this has occurred such material should be removed and the udder wiped with a clean damp cloth prior to milking. One not infrequently sees cows, the flanks and tails of which are thickly caked with manure, portions of which are liable to fall into the milk pail. Dairy cows should not be allowed to get into this neglected state.

The walls and ceiling of cowsheds should be maintained in a cleanly condition and free from cobwebs, dust, and dirt, which form suitable lodgment for disease germs. Limewash should be applied periodically to the walls and ceiling.

Disinfection of Infected Premises.

In the foregoing pages the necessity of eliminating all animals showing clinical evidence of the disease has been emphasized.

Clearly, after such animals have been removed, it is very necessary to cleanse and disinfect the stalls, stables, or other premises which they have occupied in order that other animals which are subsequently placed in them may not contract the disease.

The litter, if any, used by the diseased animal should be removed and burned or otherwise effectually disposed of. A convenient method of disposing of such material is to collect it in a heap, pour paraffin over it, and afterwards apply a light.

Next, the walls, floor, mangers, gutters, stall partitions, etc., in the building should be washed, and, if possible, scrubbed with soap and water.

After this preliminary cleansing, which is very necessary, one may proceed to apply the disinfectant solution, either by means of brushes or mops, or preferably by means of a small spray pump or a hosepipe attached to a small force pump.

For the disinfection of the walls, floor, ceiling, gutters, stall partitions, etc., any of the following disinfectants may be used: Corrosive sublimate, 1 in 1000 solution; carbolic acid, 5 per cent. solution; cresol (or creolin), Jeye's fluid, or similar preparations, 2 per cent. solution; or formalin, 5 per cent. solution. Corrosive sublimate has the dual advantages of being both highly efficient and cheap; it is, however, highly poisonous and, therefore, must be used with care. Carbolic acid is also highly efficient—it is a useful disinfectant, but somewhat expensive; the same applies to formalin.

One can recommend formalin for the disinfection of mangers and feeding troughs; as already remarked this is an excellent disinfectant, and being less poisonous than either corrosive sublimate or carbolic acid, its use is unlikely to be attended with danger.

As an alternative method of disinfection after the preliminary cleansing, the stable may be closed and fumigated. An effective disinfectant in gaseous form is formaldehyde gas (which may be prepared by adding formalin to potassium permanganate). The building should remain tightly closed and exposed to the fumes of this disinfectant for at least twelve hours, or the stable may be fumigated with sulphur dioxide gas (obtained by burning sulphur), in which case the building must be kept closed and the fumes allowed to act for twenty-four hours. Those, however, who are inexperienced in this mode of disinfection are advised to stick to the first-mentioned method, applying the disinfectant solution direct, preferably by means of a spray pump; if done thoroughly this is a highly effectual method, and, moreover, it can be satisfactorily carried out by practically any one.

After disinfection of the stable or building is completed, the doors and windows should be thrown open in order that the sunlight may gain access to every part of its interior. Afterwards the walls and ceiling should be limewashed and slaked lime may be sprinkled on the floor.

If the disease has occurred in cattle which have been kept in small yards, after removing the litter the surface of the ground may be ploughed, the fencing and other fixtures should be thoroughly cleansed and disinfected after the manner above indicated.

RELATION TO PUBLIC HEALTH.

It is unnecessary in this place to enter into a lengthy argument relating to the subject of the intercommunicability of human and

bovine tuberculosis, this having been definitely and conclusively proved by many different authorities.

Whilst in the human species, and especially in adults, tuberculosis is largely the result of infection with tubercle bacilli from human sources, it has been abundantly proved that human beings may contract the disease from the lower animals by consuming milk and milk products (butter, cheese, etc.) derived from infected cows and also by eating meat obtained from tuberculous animals (cattle, swine, etc.). Obviously milk is of greater importance in this connection than meat, since the former is usually consumed in the raw or uncooked state, and especially by children and invalids, who are particularly susceptible to infection. The meat of tuberculous animals is also dangerous, though, as just stated, less so than the milk of these animals, since flesh (meat) rarely contains tubercle bacilli except in generalized or advanced cases of the disease. Moreover, meat is practically always cooked before consumption, and the heat employed in the process of cooking, *provided always that the latter be thorough*, would kill any tubercle bacilli present.

With regard to the transmission of tuberculosis from the lower animals to man, the Royal (British) Commission on Tuberculosis in their recently issued report, state: "There can be no doubt that in a certain number of cases the tuberculosis occurring in the human subject, especially in children, is the direct result of the introduction into the human body of the bacillus or bovine tuberculosis, and there also can be no doubt that in the majority at least of these cases the bacillus is introduced through cows' milk. *Cows' milk containing bovine tubercle bacilli is clearly a cause of tuberculosis, and of fatal tuberculosis, in man.*"

Elsewhere in the report issued by the Commission referred to, the statement occurs: "Bovine tubercle bacilli are apt to be abundantly present in milk as sold to the public when there is tuberculous disease of the udder of the cow from which it was obtained. This fact is, we believe, generally recognized though not adequately guarded against. But these bacilli may also be present in the milk of tuberculous cows presenting no evidence whatever of disease of the udder, even when examined post-mortem. Further, the milk of tuberculous cows not containing bacilli as it leaves the udder may, and frequently does, become infective by being contaminated with the faeces or uterine discharges of such diseased animals. We are convinced that measures for securing the prevention of ingestion of living bovine tubercle bacilli with milk would greatly reduce the number of cases of abdominal and cervical gland tuberculosis in children, and that such measures should include the exclusion from the food supply of the milk of the recognizably tuberculous cow, irrespective of the site of the disease whether in the udder or in the internal organs."

A knowledge of these facts is of the utmost importance in formulating measures for the safeguarding of human beings against the disease under consideration.

Until fairly recently it was commonly assumed that only those cows actually suffering from tuberculous disease of the udder were capable of secreting milk containing tubercle bacilli. As above stated, however, this assumption has been proved erroneous, and it is now well recognized that a tuberculous cow may secrete milk containing tubercle bacilli even in cases in which it may be impossible to

demonstrate the existence of disease of the udder. The importance of this fact cannot be over-estimated. With regard to those animals in which the disease is not far advanced, it has been shown that these may occasionally secrete milk containing tubercle bacilli. This is true even of those animals which, apart from having given a reaction to the tuberculin test, are otherwise to all appearances in good health and condition.

With regard to measures to be adopted in order to obtain a pure milk supply, it goes without saying that all "open" or clinically recognizable cases of tuberculosis including, of course, all cases of udder tuberculosis—must be rigidly excluded from our dairy herds. Dairymen and cow-keepers should not be allowed to supply milk for human consumption so long as tuberculous animals remain in their herds. The only alternative is that the entire milk supply of such herds must be sterilized or pasteurized *under supervision* before being allowed to be used for the purpose referred to.

It will readily be understood that of the various forms of bovine tuberculosis, it is especially the "open" and clinically recognizable cases which constitute the greatest danger, not only to the cattle-owner, but to the public health in general. Such animals, as we have endeavoured to point out in the present paper, excrete tubercle bacilli in various ways, they infect other animals in their vicinity, and contaminate the surroundings, including the milk, or they may secrete milk actually containing tubercle bacilli.

In the towns and centres in this country in which tuberculosis amongst dairy cows exists, dairymen or cow-keepers supplying milk for human consumption should be compelled to report to the Veterinary Department the existence of *any disease* amongst animals in the dairy herd, especially should they be compelled to notify the presence of *any* disease of the udders of their cows. Moreover, frequent veterinary inspections should be made of all animals which supply milk for human consumption.

In this connection, Dr. Savage (an authority on the subject), in a recently contributed article to the *British Journal of Tuberculosis*, remarks: "Immediate action is required to deal with existing conditions and to prevent tubercle bacilli being shed into milk from cows with tuberculous udders or clinically diagnosable tuberculosis. . . . All cows excreting tubercle bacilli, if not killed, should be branded so that they may never be used for milk production. To find out such animals an adequate staff of veterinary inspectors must be provided, while bacteriological facilities will have to be much more extensively employed." With this suggestion we are in agreement: we consider, however, that as is the custom in this country, all "open" and clinically recognizable cases should be unhesitatingly slaughtered without loss of time, since such animals constitute a grave source of danger.

In connection with the subject dealt with, one may here repeat a suggestion embodied in a paper contributed by the present writer to a veterinary journal in 1905. The statement referred to reads as follows: "In view of the danger to the public health, the milk from *animals tuberculous in any degree* should be absolutely debarred from use for the food of man, unless efficiently sterilized" (to this we would now add the words "under supervision," the addition of these words being very necessary).

The milk consumer is strongly advised to obtain milk from herds which are free from tuberculosis, and he would be well advised to purchase at slight additional cost "certified" or "tubercle-free" milk whenever this article is available. ("Certified milk" means milk which has been certified by a responsible authority as produced under sound sanitary conditions from cows which are free from tuberculosis; the term "tubercle-free milk" is self-explanatory.)

Where any suspicion attaches to the milk—in other words, unless it is obtained from animals which are known to be free from tuberculosis—the milk consumer is advised to boil or to pasteurize all such milk before using it for food purposes, in order to destroy any tubercle or other disease-producing organisms which may be contained in it. There are, however, certain objections to the use of milk which has been so treated, and undoubtedly it is infinitely preferable to obtain milk which is pure in the first instance whenever it is possible to do so.

STERILIZED AND PASTEURIZED MILK.

As already stated, the milk consumer may obviate all danger of contracting tuberculosis from milk by sterilizing (boiling) the latter. Boiled milk is, however, unpalatable, and many persons have decided objections to its use for food purposes. Moreover, it is believed that, compared with the raw or uncooked article, boiled milk is of lower nutritive value.

Another method of treating milk with the same object is that known as "pasteurization"—a process by which the milk is submitted to a temperature lower than the boiling point. As to the temperature necessary to destroy or render inert any pathogenic (disease-producing) organisms—including tubercle bacilli—which may be present, this is accomplished by heating the milk at a temperature of 176° F. (80° C.) for five minutes, or at 149° F. (65° C.) for twenty minutes.

Milk which has been treated in this way is perfectly safe in so far as the danger of transmitting disease to the consumer is concerned, and pasteurized milk has not the same peculiar (and to many objectionable) flavour which is associated with milk which has been boiled.

Of the two processes, sterilization and pasteurization—if it be necessary to adopt either—it seems to the writer that the simplest method is the best, and, with Professor Welsh, we advise that the milk be raised to the boiling point and then allowed to cool, taking care to keep the vessel covered so that no "skin" is formed to protect the bacilli therein contained against the full effects of the heat and to prevent subsequent contamination of the fluid.

Certain objections have been advanced against the use of pasteurized and sterilized milk. It is not necessary or desirable to enter into a discussion of these here. One may, however, quote the following summary (by Ayres and Johnson) of the objections to pasteurization which are generally accepted as being well founded:—

1. It is believed that the lactic acid bacteria in raw milk (which eventually sour the milk) exert a restraining influence on the peptonizing bacteria which would otherwise cause the putrefaction of the milk. In other words, when milk is pasteurized and subsequently

kept free from lactic acid bacteria (which are easily killed by heat), it will not sour but will *putrefy*, due to the uncontrolled development of peptonizing bacteria (the spores of which are not destroyed during pasteurization). The peptonizing bacteria, when freed from the restraining influence of the lactic acid organisms, may increase in large numbers and produce toxins and poisonous decomposition products.

2. The pasteurization of dirty (and infected) milk, while reducing the bacterial numbers, does not destroy the toxins or other products of bacterial growth. (Says Rotch in this connection: "It is a fact that certain organisms are killed by pasteurization, but we cannot kill the toxins of these organisms by heat. Simply pasteurizing or sterilizing will still allow the milk to contain elements which are exceedingly dangerous to those who drink it and especially where young infants are concerned.")

3. Pasteurization may be used simply to cover up dirty milk; it may encourage dirty methods of production and retard the extension of sanitary supervision.

4. Milk which has not been sold may be pasteurized or even repasteurized and its faults hidden.

5. Undesirable changes may be produced by heating, which result in making the milk less digestible, particularly in the case of infants.

Says one writer in referring to this subject: "Pasteurization, if to be advised, must be efficient and genuine, and it would be well if public health authorities had powers of supervision over the dairies where it is in vogue. But these measures (sterilization, pasteurization) are mere palliatives, and like all palliatives they are unsatisfactory. *Only one measure can really be considered efficient, and that is the eradication of clinical tuberculosis from the cows in our milking herds.*"

ANIMAL TUBERCULOSIS FROM THE POINT OF VIEW OF MEAT INSPECTION.

With regard to the utilization for food purposes of carcasses or parts of carcasses of food animals which are the subjects of tuberculosis, the custom is that where the disease is strictly localized—that is, when it is confined to one particular organ or group of organs—the diseased organs and the lymphatic glands in connection therewith are condemned and destroyed, the rest of the carcass, if on examination it be found in good condition and free from all evidence of disease, being passed for food purposes.

Where, however, the disease is extensive, especially if generalized (i.e. distributed throughout the body), where lesions are found in the muscles (flesh, meat) or in the lymphatic glands embedded in the muscles, or where lesions of the disease are found in any part of an emaciated carcass, the entire carcass and viscera are condemned and destroyed.

Bearing on this point, the Royal Commission on Tuberculosis in their report published in 1898, issued the following recommendations regarding the carcasses of tuberculous animals:—

"We are of opinion that the following principles should be observed in the inspection of tuberculous carcasses of cattle:—

(*a*) When there is miliary tuberculosis of both lungs, (*b*) When tuberculous lesions are present on the pleura and peritoneum, (*c*) When tuberculous lesions are present in the muscular system, or in the lymphatic glands embedded in or between the muscles, (*d*) When tuberculous lesions exist in any part of an emaciated carcass,	The entire carcass and all the organs may be seized.
(*a*) When the lesions are confined to the lungs and the thoracic lymphatic glands, (*b*) When the lesions are confined to the liver, (*c*) When the lesions are confined to the pharyngeal lymphatic glands, (*d*) When the lesions are confined to any combination of the foregoing, but are collectively small in extent,	The carcass, if otherwise healthy, shall not be condemned, but every part of it containing tuberculous lesions shall be seized.

In concluding this part of the subject, one cannot do better than quote the following extract from the writings of a well-known authority on the subject of meat inspection (Ostertag), the remarks contained in this extract being of considerable importance in connection with the matter now under consideration:—

"All organs affected with tuberculosis must be excluded from the market as dangerous food material. In this connection, it should be observed that also those organs are to be considered tuberculous in which we find merely an affection of the lymph glands, for although it is known that tubercle bacilli possess the power of penetrating intact epithelia and producing alterations in the neighbouring lymph glands, nevertheless we do not know with certainty, in individual cases, that no tubercles are actually in the organs. The organs cannot de dissected to such an extent that all macroscopically visible tubercles in them may be demonstrated. Moreover, even if this were true, the foci which stand on the borderland of macroscopic visibility might escape our attention. For this reason all lymphatic glands at the natural openings (alimentary and respiratory tracts) *in every food animal* should be carefully examined for the presence of tubercles by palpation and incision."

This authority then proceeds to emphasize the necessity of condemning an *entire* organ, together with the corresponding lymphatic glands in every case in which even but a slight trace of tuberculosis may be present in the former. He particularly emphasizes the necessity of condemning every organ, even though to the naked eye it appears free from tuberculous lesions, if evidence of the disease is apparent in the lymphatic glands in connection with that organ.

From the foregoing it will be apparent that from the point of view of safeguarding the interests of the meat-consuming public, much responsibility devolves on the individual who is charged with the duty of examining animals slaughtered for food purposes, and this official should be possessed of sound pathological knowledge in addition to being a specialist in the disease of animals.

In this connection one is compelled to make the statement, astounding but nevertheless true, that in so far as concerns South

Africa, except in two of the larger towns, official meat inspection is practically non-existent. It is left to the butcher and meat purveyor—interested parties lacking in special knowledge of the subject—to determine whether any animal which they slaughter for food purposes is healthy, and whether the carcass of such animal and the meat thereof is, or is not, free from disease and fit for food purposes!

True, any sanitary authority would condemn as unfit for human consumption any meat found putrid and obviously decomposed, but in the majority of instances no attention whatever, or, at any rate, very little, is paid to the conditions under which food animals are handled and slaughtered and as to whether they are free from disease or otherwise.

When one thinks of the serious diseases such as anthrax, tuberculosis, etc.—not to mention the many parasites and parasitic diseases—which are transmissible from animals to man, one can but express surprise that any community can be found at the present day sufficiently trusting and careless enough to tolerate this "happy-go-lucky" state of affairs.

Needless to say *all* animals slaughtered for food purposes should be submitted to careful ante and post mortem examination by a duly qualified official in order to determine their freedom from disease and the soundness or otherwise and general suitability for food purposes of the carcass, meat, and edible organs.

As to the qualifications of the meat inspector, in several of the large towns in Great Britain (London, Glasgow, Edinburgh, Manchester, Sheffield, Hull, etc.) the inspection of meat and of animals slaughtered for food purposes is under the supervision of veterinary surgeons appointed by the respective city and municipal authorities. In this connection it may be said that the most enlightened and up-to-date countries in regard to meat inspection—such as Germany, the United States of America, France, Australia, etc.—have relegated this duty to the duly qualified veterinarian, his training and knowledge of pathology and of animals and their diseases specially fitting him to discharge the duties appertaining to this post.

TUBERCULOSIS OF SWINE.

Tuberculosis in swine is by no means uncommon, and there are indications that the disease in these animals is on the increase. According to Eber, at the Berlin abattoirs, whilst only 8.70 per 1000 carcasses of pigs were found affected with the disease in 1885, this had increased to 47.4 per 1000 in 1905. In South Africa, unfortunately, there is no regular system of inspection of slaughtered animals, and therefore it is impossible to state in exact figures the degree of prevalance of tuberculosis amongst our swine. It is, however, well known that tuberculosis is present in the pigs of certain districts, and as is the case in other countries in which it has gained a firm footing, there are indications that the disease is on the increase in this country. This can hardly be wondered at when one takes into consideration the extraordinarily heterogeneous collection of materials which enter into the dietary of swine, and the fact that in many of our country districts these animals seem to wander at will and to play no mean part in acting as scavengers for the general community.

As to the source of infection in swine, contrary to what happens in cattle—in which infection from man, or indeed from any animals other than those of the bovine species, rarely, if ever, happens in practice—the investigation of the Royal Commission on Human and Animal Tuberculosis have shown that swine may contract the disease from tuberculous animals of any species (bovine, human, avian), infection from bovine sources being, as one would expect, of most frequent occurrence, the disease in these animals resulting in many instances from the ingestion of milk (or of separated milk, buttermilk, etc.) or of faeces (or material which has been contaminated with the faeces) of tuberculous cattle.

But in certain districts of this country in which tuberculosis is met with amongst swine, it would seem that one must look to some source of infection other than that of cows' milk, since, in the districts referred to, tuberculous cows or cattle are believed to be a rarity. It has been suggested that infected (tuberculous) human beings may play a greater part than is generally supposed in the dissemination of tuberculosis amongst pigs in these districts. Whether or not this is actually the case, the matter is one requiring further investigation, for, apart from the loss inflicted on the pig breeder and keeper by the pi ence of the disease amongst his animals, porcine tuberculosis constitutes, to a certain extent, a danger to the public health.

In the foregoing pages it has been pointed out that tuberculosis in swine is in practically all cases acquired by ingestion, i.e. it is "a feeding disease," and as one would consequently expect, the lesions in these animals are almost invariably encountered in organs or tissues in relation to the alimentary or digestive tract.

The parts first affected are the lymphatic glands of the throat and neck (submaxillary, pharyngeal, and cervical), and in a number of cases these may be the only lesions found. Often, however, the disease extends to the intestine and mesenteric glands, from which it may extend to the liver and other abdominal organs, and to the lungs and thoracic organs. The disease may become generalized, indeed generalization is of rather frequent occurrence in porcine tuberculosis.

The lesions of the disease in swine resemble those encountered in tuberculous cattle and which have been already described. As previously mentioned, lesions of tuberculosis are of frequent occurrence in the spleen (milt) of tuberculous swine in certain forms of the disease met with in these animals.

Relation to Public Health.—The prevalence of porcine tuberculosis constitutes a danger to the meat-consuming public, the carcasses of these animals being, of course, extensively utilized for food purposes. It goes without saying that *all* pigs slaughtered for food purposes should be carefully examined, ante and post mortem, the occurrence of tuberculosis and other diseases transmissible to mankind in these animals rendering this course absolutely imperative.

With regard to the disease now under consideration, the Royal Commission on Tuberculosis recommended that "in view of the greater tendency to generalization of tuberculosis in the pig, we consider that the presence of tubercular deposit in any degree should involve seizure of the whole carcass and of the organs."

TUBERCULOSIS OF SHEEP AND GOATS.

Tuberculosis seldom occurs in sheep and goats. The writer has

not yet encountered a case in this country, and as far as one is aware there are no published records of its occurrence in these animals in South Africa, although the Senior Veterinary Officer of the Cape Province (R. W. Dixon, Esquire, M.R.C.V.S.) states (private communication) that he has met with the disease in goats at the Cape in at least one instance, the infected animal in this case being stall fed and kept for milk production.

According to Ostertag, in different parts of Germany during certain years the percentage of tuberculous sheep was found to range between .0029 and 1.26. As this authority remarks, the rarity of tuberculosis amongst sheep and goats applies only to animals whilst living chiefly in the open air. It has been noted that as a result of keeping goats in stalls they become tuberculous to the same extent as cattle.

The lesions of the disease encountered in tuberculous sheep and goats resemble very closely those met with in cattle. Care must be taken not to mistake for tuberculosis a disease of not infrequent occurrence amongst sheep in this country—at any rate in the Cape Province. The disease referred to is caseous lymph-adenitis (sometimes termed pseudo-tuberculosis). In this disease lesions are encountered in certain of the lymphatic glands which might mislead the inexperienced, but caseous lymph-adenitis has nothing in common with tuberculosis, and the two diseases are totally separate and distinct.

A short description of the disease caseous lymph-adenitis was published in the *Cape Agricultural Journal*, Vol. XXXII, No. 6, page 723, to which, for further information, those who are interested in the subject are referred.

Chicory Growing.

By JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

ON account of the demand for chicory-root (*Cichorium intybus*) we have received inquiries as to the possibility of growing it in the Transvaal. There is a large consumption of chicory in South Africa; the Cape Province alone imported 1,052,145 lb. in one year, valued at over £8750, and the Transvaal imported to the value of £3396 in one year.

The chief use of chicory-root is for mixing with coffee; though this may be called an "adulteration" many persons who are accustomed to it prefer a mixture of chicory and coffee to pure coffee; it appears to have no injurious effect on the human system. Chicory is also used medicinally, and, to a limited extent perhaps, in the preparation of porter and snuff. In Europe the young leaves

are used in salads, and sometimes like spinach, and the tender young roots are used as a vegetable like carrots. It is also grown sometimes as a pasture crop, particularly on dry lands, for being deep-rooted it is able to withstand drought better than the ordinary pasture grasses; the leaves should not be fed to milch cows as they are apt to make the milk bitter.

Present supplies of chicory-root are obtained from northern Europe. The United States and Great Britain produce little more than enough for their own use. Although chicory can be and has been grown successfully in the Cape Province in the Paarl Division, Alexandria, Queenstown, and East London, but especially round Kingwilliamstown, none appears to be grown commercially at the present time, although it is stated by manufacturers that "there is not only a market waiting, but also manufacturers ready and willing to take it if they can obtain a steady supply in sufficient quantity." If the crop is a profitable one, it is surprising that Cape Province farmers ceased to cultivate it, when the local demand exceeded a million pounds weight, and when it was protected by an import duty of 2d. per lb. The reason is not quite clear, and farmers would do well to look into the question of supply and demand for the crop before embarking on the industry. It should also be borne in mind that to grow the root successfully and profitably, careful attention and considerable labour are required; it is not by any means a crop for a lazy man to handle.

TRANSVAAL EXPERIMENTS.

As chicory does not appear ever to have been grown commercially in the Transvaal, and as it had grown well as a pasture plant I decided to give it a trial as a root-crop, at the Botanical Experiment Station at Skinners Court, Pretoria, and at the sub-station on the Springbok Flats. These experiments were conducted in the years 1905-09. The earliest results were not satisfactory, but after two failures we were able in 1907 to report quite favourable returns (4 and 5). This, again, illustrates the necessity for repetition of experiments under varying methods of treatment, times of sowing, etc. There is far too much tendency to draw definite conclusions from too limited a number of experiments, and for this the public which vote the funds to support Government departments are often to blame. Without labouring this point unduly I could cite many instances where results drawn from but one or two experiments have been the cause of hanging up an industry for years.

RAINFALL.

It would appear that an evenly distributed rainfall during the growing season, or its equivalent in irrigation, are required to produce a full, even stand, and well-developed roots. At the Springbok Flats our experiments were not satisfactory, due, perhaps to the late arrival of the rains and the lack of a sufficiently continuous rainfall to establish a full stand and to allow the plants time to produce well-developed roots. At Skinners Court, also, the incidence of the rainfall (only 1½ inches in January) greatly checked the growth of the seedlings. A large percentage of the seedlings died from the "lifting" of the soil in dry weather. When once established the plants never showed any sign of suffering from drought, but the difficulty experienced in securing a good stand was a decided drawback.

It is evident, therefore, that time of sowing the seed will have an important influence on the development of the stand.

SITUATION.

The situation of the land for chicory growing requires consideration. Whether a bult should be chosen, or whether bottom land will be preferable, will depend on the texture of the soil and the moisture present, unless is is intended to irrigate. The land should be well drained, i.e. it should not carry stagnant water, nor be too wet for other crops. Wet soils hinder early growth, prevent proper "ripening" of the roots, and cause the latter to rot off.

On the other hand, though it is true that soils too dry to produce some farm crops will grow chicory for stock feed, it is probable that such soils would be too dry to produce good chicory-roots.

Newly-broken veld has not been found well-suited to this crop.

Chicory may be grown either as a dry-land crop, or with a limited amount of irrigation; the yield may often be increased from 50 to 100 per cent. by the application of water.

SOILS.

Chicory is adapted to any good loamy soil which will produce good root crops, such as mangels, carrots, or sugar-beets. But the soil generally considered most suitable is a sandy loam, provided it has a sufficient water supply. At the same time it must not be water-logged, for the roots rot easily. It prefers a soil containing lime and will grow on lands which are somewhat "brak." Although chicory will grow in most kinds of soil, the selection of the most suitable soil is of the greatest importance for the production of good marketable roots, and the success or failure of the crop will largely depend on the soil and its proper treatment. Hard, shallow or heavy soils are apt to produce short, crooked, forked roots of no commercial value.

The heavy, blackish, clay-loam soils ("black turf") near Pretoria, are apt to get very wet in summer, but crack or "lift" and dry out in dry weather, causing the seedlings to die through exposure of the roots to dry air; but in other respects they seem suitable; perhaps under irrigation this difficulty would be overcome. Sandy soils, on the other hand, are apt to be too dry.

It is particularly desirable that the sub-soil should be loose and friable; the presence of hard-pan, ooklip, or similarly impermeable layers near the surface, prevents the full downward development of the long tap-root. The presence of stones is apt to make the roots irregular and unshapely.

Clayey and "turfy" soils are also apt to produce dirty roots, for which the manufacturer deducts about 5 per cent. from the price he pays the farmer. In such soils it is also more difficult and expensive to harvest the crop.

Soils too rich in nitrogenous matter (e.g. kraal manure) may produce too much leaf and stem at the expense of the root.

Manures.—On very poor soils a limited quantity of kraal or stable manure may be used with advantage, but it is often too rich in nitrogen and too poor in potash and phosphoric acid; the latter plant-foods are of great importance to this crop. Artificial manures containing these fertilizers will probably be found advantageous where they are lacking in the soil, but before using them it would be advisable to have an analysis made of the soil on which it is proposed to grow the crop, in

order to determine what is lacking. If stable manure is to be used it should preferably be applied to the crop preceding the chicory. Soils deficient in lime should be treated to a dressing of this substance.

It is not profitable to grow chicory on the same ground indefinitely; the yield and quality are sure to suffer. It would, therefore, be desirable to grow this crop in rotation with others, such as maize, mangels, velvet-beans, cow-peas, sugar-beans, or soy-beans; the beans or peas should precede the maize crop.

Preparation and Cultivation of the Soil.—To produce good roots, *deep* ploughing, and cultivation of the soil are essential; ploughing and sub-soiling to the depth of at least 10 inches should be done in the autumn, after the maize or mangel crop has been harvested, the land being left rough and open for winter fallow. In the spring it should be thoroughly harrowed and deeply cultivated to get the soil into good loose condition to allow of the fullest possible development of the roots.

Seed-sowing.—The seed should not be sown until the soil has been brought into the best possible condition, and the weather is favourable; probably September or October will be the most suitable time for the high veld, if the ground can be irrigated thoroughly; if the rains come late it may not be safe to sow before November. As an irrigated winter crop in the middle veld, sowings at the end of February or in March may be satisfactory in some districts, but this must be determined for each locality by local experiment; if sown too early, the plants are apt to throw up flower-stems, and the roots of such plants are worthless from the manufacturer's point of view. Seed should be sown in drills 12 to 15 inches or 18 inches apart, according to circumstances, and the seedlings thinned out, by degrees, to 4, 8, or 10 inches in the row. A "Planet Junior," or other hand drill which will not clog, may be used, and about 1½ to 2 lb. of seed per acre will be required.

Only the best seed should be used, preferably that which has been grown especially for root production. It should give a germination of about 85 per cent. and purity of 90 per cent. In Europe it is customary for the factories to supply the seed to the growers, and this seed is generally superior to that obtainable in the open market.

Varieties.—There are several varieties in cultivation, some of which give better roots than others. The "Brunswick" and "Magdeburg" varieties are largely grown for the roots, and a cross between the Brunswick and Silesian is said to have been particularly successful in the Cape Province. The "Magdeburg" is longer in the root, and is said to be rather harder to lift, than the "Brunswick." The "Elite" is also recommended by American growers.

After-cultivation should be practised, both to keep the crop free from weeds and to keep the surface soil loose. For this work the hand hoe is generally preferred as it allows the rows to be sown 12 inches apart, and permits of more thorough and uniform cultivation; the hoeing should be quite shallow, only deep enough to kill the weed-seedlings and loosen the surface; deep hoeing is said to be prejudicial to the formation of good roots. When the plants are an inch or so high, they should be thinned to 4 inches and finally 8 or 10 inches in the row according to growth; no two plants should be left to grow side by side, as the two roots so grown are generally smaller and less valuable than one would be if grown singly. The general treatment is much the same as for carrots, but the crop requires less water. At least two cultivations after thinning are desirable, after which it will

be necessary to remove any large weeds and such chicory plants as have gone to flower.

Harvesting, Market, etc.—Chicory requires from five to six months to ripen, under favourable conditions. In an old number of the *Cape Agricultural Journal* it is stated that it is ready for lifting "when the lower leaves are turning yellow, and when the root breaks across with a short fracture, and is full of milky juice, not dry and fibrous, in which case the chicory is gritty and tasteless. . . . Lift the roots in dry weather so as to keep them clean; cut the tops off, but not so low that they will bleed. A common mistake is to dry the roots too early or too late, and in either case chicory of much diminished value results." (3.)

In Europe the yield ranges from 3 to 10 tons per acre on dry lands, and up to 15 tons with irrigation and particularly good cultivation; in the United States the average yield is between 6 and 8 tons. At Skinners Court we obtained at the rate of 5 to 8 tons.

In the Cape Province good, ripe, fresh roots have been known to bring up to £2. 10s. per ton at the factory. One factory alone was able to deal with 150,000 lb. weight of fresh root per week.

The writer in the *Cape Agricultural Journal*, above referred to, wisely observes that "Chicory must not be regarded as a crop from which fortunes are suddenly to be made, but it is certainly worth cultivating along with others, where conditions are suitable. Where chicory is found by experiment or previous experience to answer, it is of the utmost importance to farmer and manufacturer alike to arrange and ensure that a regular supply may be forthcoming. Without this the industry of chicory drying and grinding is hopeless and impossible, as witness the fact that factories have for months past been idle, and, unless special inducements offer and a regular and considerable supply can be guaranteed, will not commence work. . . . Prospective growers would, therefore, do well to come to some arrangement with manufacturers previous to embarking upon the cultivation of chicory, and it would seem particularly desirable that a number combine so as to furnish the necessary amount and to distribute the supply over a longer time." (3.)

I am inclined to think that chicory will be more satisfactory as a market garden crop than as an ordinary farm crop, as it seems to require that patience and close attention to detail which are given by market gardeners, rather than the broader methods of treatment which the ordinary farmer is obliged to apply. But how it will compare with ordinary market-garden crops as regards profits will have to be worked out.

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Forestry in relation to Irrigation in South Africa.

A PRACTICAL PROPOSITION.

By K. A. Carlson, Conservator of Forests, Orange Free State.

I.—Influence of Forests on the Movement of Water.

In a country like South Africa, where the largest tracts of riparian land lie in regions where the water supply is meagre, or at any rate very irregular, and either amounts to a feast or a famine, any means by which it is possible to increase and conserve the storage, and thereby promote a more regular flow, strikes at the very root of the whole subject of irrigation, and must command our most active and careful study.

Why is it that our rivers are notorious for not being navigable? Why had our friend the Director of Irrigation to be at such pains to find a workable definition for "normal flow"? And why does the precious fluid in our rivers only provide us with occasional feasts, and most of the time leave us to starvation and famine? It is true that these effects are the immediate result of the nature of the rainfall, but it is also true that, in spite of the unequal distribution of that rainfall, it would not be so if our mountain slopes were covered with forests. Owing to the want of practical examples at hand, few of us realize the extent to which forests can modify these extreme conditions.

Forests may be said to be the most powerfully modifying agent on earth. They exercise their influence on wind, temperature, evaporation, and precipitation, on the condition, composition, and movement of soil. but, above all, on irregular stream-flow. Every kind of vegetation, if present in sufficient quantity, such as grass, for instance, has the power to check the rapid run-off from hill and mountain slopes to a certain degree, but their influence is very limited compared to that exercised by forests. If the grass be sufficiently abundant to check erosion, its roots form such a dense mass, and compact the surface soil to such an extent, that only very heavy and continuous rain can penetrate to the sub-soil, while the vast bulk of the water rapidly finds its way into streams and river beds. The small amount of water that is caught and held by the grass is soon evaporated by wind and sun, against which there is no protection, while the grass itself does not take long to absorb what little moisture has been retained in the upper layers of the soil. Contrast this condition with that of forest-clad slopes, and the enormous influence of the latter in conserving the rainfall will at once be apparent.

Most of our rains inland fall in sharp, heavy storms, the direct mechanical action of which is to harden the surface of the soil and reduce its power to absorb moisture. In the first place, the canopy of a forest prevents this action by breaking the force of the fall and conducting the rain gently through the foliage and along the stems

to the ground. Arrived here the water encounters a thick layer of humus formed by fallen leaves and pine needles. This humus is in itself capable of absorbing from one to four times its own weight of water, according to the composition of the forest, a mixture of conifers and deciduous trees being the most effective. Having saturated the crowns and the layer of humus, the rain next begins to percolate into the soil below, which it finds in an exceptionally favourable condition for its reception. Not only is the surface soil kept porous by the double covering of canopy and leaf-mould, but the tree roots penetrate to great depths into the sub-soil and cracks and crevices in the rocks, allowing vast quantities of water to enter on its way, by subterranean passages, to replenish the springs that eventually feed the streams and rivers. Having once absorbed and stored these treasures, the forest jealously mounts guard over them, and sees to it that no reckless squandering takes place by evaporation through the influence of sun and wind. Extensive investigations have proved conclusively that evaporation inside a forest is very much less than outside, due to the modifying influence it exercises on temperature and air currents. Thus the amount evaporated from a forest soil without leaf-mould is 53 per cent. less than from soil in the open, and that from a forest soil with a full layer of leaf-mould is 78 per cent. less than in the open.

Although no definite conclusion has been arrived at whether forests influence the total rainfall, it is unquestionably true that they act as excellent condensers of vapour, and under certain circumstances tend to increase local precipitation. Take, for instance, a moisture-laden sea-wind travelling inland and striking a mountain range. We all know that on ascending to higher and cooler altitudes this moisture is condensed and precipitated in the form of rain, mist, or dew. By spreading a dense forest mantle over such a mountain range we lower its temperature in summer, and thereby attain to saturation point even more readily. And this condition is still further accelerated by the atmosphere above a forest being already charged with a certain amount of moisture due to transpiration from the foliage of the trees. Investigations in Prussia have shown that, while this increase in precipitation due to presence of forests only amounts to 1.25 per cent. between sea-level and 328 feet elevation, it reaches as much as 43 per cent. at an altitude of between 2297 and 2625 feet.

Having thus roughly dealt with the conservative factors of forests, let us not omit any that may have the opposite effect. In European forestry it is generally estimated that about 23 per cent. of the total rainfall does not reach the ground, but is retained by the foliage and mostly re-evaporated. This percentage should, however, be considerably reduced for localities where the rain mostly falls in heavy storms. It should also be remembered that this evaporation of moisture from the crown helps to retard evaporation from the leaf-mould underneath. Another point to take into account is that the trees consume and transpire a certain amount of moisture in their vegetative processes. Very few data exist on this subject, owing to the complicated nature of the investigations involved. Results vary with the nature and physical conditions of the soil, amount of rainfall, and kind of trees. Speaking generally, it has been found that forests only require one-half the amount of moisture that field crops do, and the

quantity they consume must therefore be considered very small compared with the vast quantities they store through their conservative influences.

II.—THE ORANGE RIVER SYSTEM.

The question now is: Have the above principles any practical bearing on South African conditions? Of the 1,600,000 acres of forests at present under the control of the Union Forest Department, about 97 per cent. are scattered between the coast line and the southern and eastern slopes of its nearest mountain ranges in the Cape and Natal Provinces. The remaining 3 per cent. are found on the eastern slopes of the Drakensberg in the northern Transvaal. But none of these have any practical connection with the sources of the rivers on whose waters we mostly depend for irrigation. The most prominent of the latter is the Orange River and its main tributaries, the Vaal and Caledon. The head waters of these rivers originate along the western watershed of the great Drakensberg range over a distance of some six or seven hundred miles. From this watershed to the outlet of the Orange River is a distance, as the crow flies, of seven to nine hundred miles, but the windings of the main streams alone cover several thousand miles of country, much of which is excellently suited for irrigation. In spring and early summer of 1905 I personally observed the Vaal River reduced to small stagnant pools. The same drawback has, at different times, been experienced on the Caledon. The Orange River itself may not quite reach that extreme, but it gets very low for long periods, and, as will be shown later, there is no guarantee that its present condition will remain a permanent feature in the future. On the other hand, the enormous volume of water that escapes in a few days during the rains is astounding. During a flood in 1898 the Orange River was gauged at Aliwal North bridge, when it was found that the water discharged amounted to no less than 330,000 cubic feet per second. That means that during every twenty-four hours sufficient water was discharged for the full annual irrigation of no less than 350,000 acres.

The practical question before us, therefore, is whether it is possible to cover this watershed or any parts of it with a sufficiently dense mantle of forest to store the rainfall and thereby regularize the stream-flow of these rivers.

With this object in view, let us first examine the regions concerned. Speaking geographically, we may divide that part of the Drakensberg with which we have here to deal into three sections—the northern, central, and southern sections. The first of these may be taken to extend southwards from a point in the Ermelo District, where the most northern of the tributaries of the Vaal takes its rise, to a point where Natal, Free State, and Basutoland find a common beacon at Mont aux Sources, the most famous landmark on the range. Along this part of the range the western watershed is not of a mountainous character, but forms a more or less hilly plateau with a very gradual fall westward. In the second or central section the western watershed of this great range breaks up into an extensive tract of rugged mountainous country approximating to some 15,000 square miles, and embracing the whole of Basutoland and a portion of the north-eastern districts of the Free State. The final and southern section passes in a comparatively narrow belt through the north-eastern districts of the Cape Province for a distance of about 200 miles.

If we now trace the courses of the smaller tributaries of the main branches of the Orange River, we find that those of the Vaal that join it east of Vereeniging originate partly in the north section of our watershed, and partly in the extreme north portion of the central section. The Caledon originates in the northern and western parts of the central section, and the Orange itself in the central and eastern parts of the central section. Although the soil and climatic conditions in the northern section are in most parts very favourable for tree growth, this region does not, as a whole, present the characteristics of a great mountain storage. These are more in evidence in the southern section, though climatic conditions are here somewhat less favourable to tree growth. But it is in the central section that we find the most ideal conditions for a great national forest reserve. Here is an extensive tract of lofty mountains which may aptly be described as the South African Alps, and which hold within them the true elements for a great natural water reservoir.

III.—A PRACTICAL SCHEME.

Enough has been said to prove the great benefit to the future of irrigation over a very extensive riparian tract of country, if it be possible to cover these South African Alps with forests. Later I propose to show that to do so is not only desirable, but a question of vital importance to the country. Meanwhile let us inquire whether such a proposition is practicable.

The practicability of the scheme rests on three issues:—(*a*) Whether the physical conditions of the locality are favourable for supporting a dense forest growth; (*b*) whether other technical and practical questions concerning its execution can be met; and (*c*) whether the financial investment is sound. In dealing with the physical features of the locality it must be noted that certain theorists hold that the mere fact of there being no indigenous forests is negative proof that the conditions are unsuitable for any kind of dense forest growth. On the other hand, the results of every attempt at positive proof of this assertion by actual experiments go to confirm the contrary. The species that go to make up our principal indigenous forest flora are mostly of a very sensitive nature, demanding special and exacting climatic conditions such as are only found in the deep, moist, and sheltered kloofs on the south-eastern slopes of our moister mountain ranges. If we attempt to transfer any of these, even a short distance, into an exposed situation, they remain stunted and useless even if they do not entirely fail. Then, again, we have another type of tree growth, which we might call the mimosa type, far more ubiquitous and less exacting than the former, but not capable of being classed with the type of forest of which we are in search. When we turn our attention to the remarkable success attending the introduction of a large variety of exotic trees into South Africa, many of which flourish under conditions very widely separated from those pertaining to our indigenous forests, we are left to wonder by what unlucky chance these were excluded from the forest flora of our continent at the time of its reconstruction and début upon the scene of our present geological and climatological era. But let us confine our inquiry to our present objective, the central section of the head-waters of the Orange River system.

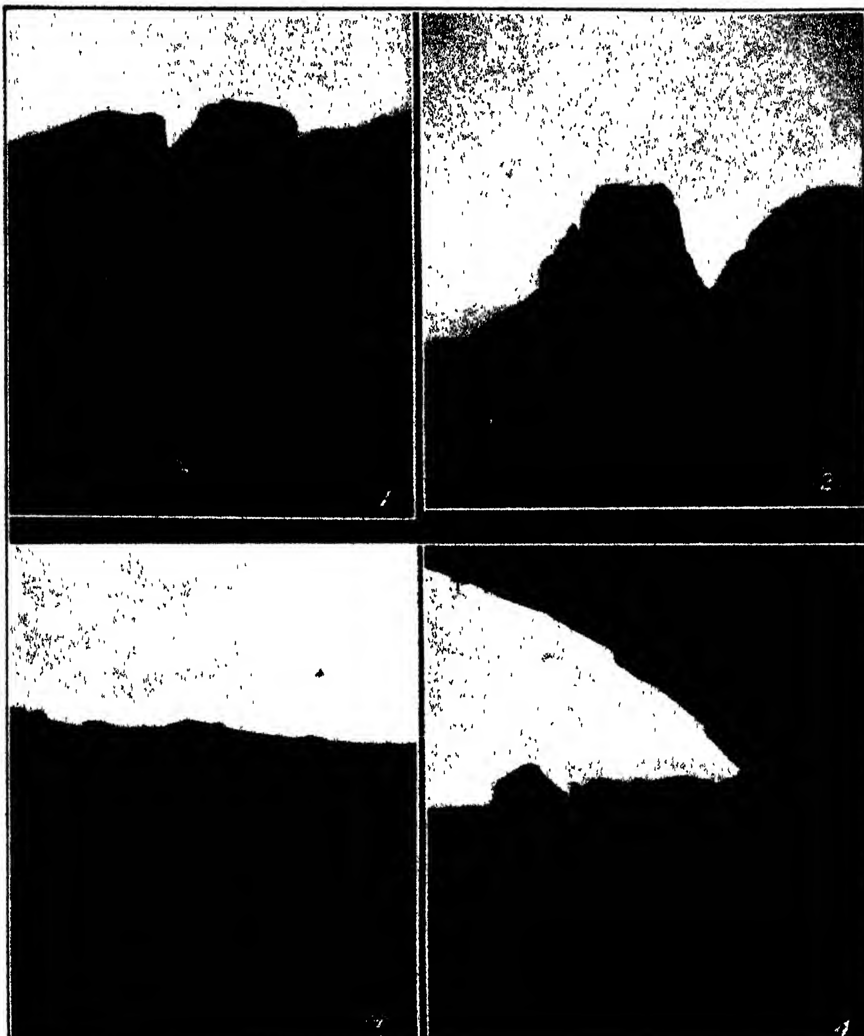


Plate No. XII.

1. The summit of Mont aux Sources. 2. The Buttress on the Mont aux Sources.
3. The slopes of the Maluties. 4. Mont aux Sources from the Cave, Witzieshoek.

The general formation of this section is that of the cave sandstone, for elevations up to 6000 and 7000 feet, overlaid by doloritic rocks to altitudes ranging up to 11,000 feet. The soil resulting from the decomposition of both these rocks and their blending in varying proportion is well known to the South African forester as exceptionally favourable to the growth of many kinds of exotic trees, and is also amply testified to by those planted within the past 30 or 40 years. Here, therefore, we have positive proof of the suitability of the soil. But, the critic may say, what about the rainfall and other climatic influences? There may be sufficient moisture to maintain individual trees, but not for a dense forest cover such as would be required to form a storage reservoir to support a permanent streamflow. It is just here that our judgment may become clouded by comparison with our indigenous South African forest flora. Let us instead look for comparisons in other parts of the world where are the homes of some of the timber trees that seem to find with us congenial conditions for development. Of these perhaps the most striking example to illustrate our present point is to be found in the forest region of the Colorado Plateau in the South-Western United States. Barrington Moore, an American forest officer, in a recent number of the *Forest Quarterly*, states that the largest continuous body of pine in the world is found here, consisting of western yellow pine (*Pinus ponderosa*), and that it is of immense importance for timber production and "watershed protection." In a planting leaflet on this tree, issued by the American Forest Service, it is stated: "The wood, which is light, strong, dense, and moderately durable, is the most valuable one of the Rocky Mountains, and the most extensively used. Because of its dense foliage and ability to grow in close stands the tree forms an excellent watershed cover."

The Colorado Plateau lies between the 34th and the 37th degree of north latitude, 300 to 400 miles inland from the Pacific Ocean. Its average elevation is about 7000 to 8000 feet, but in parts rises to altitudes of 10,000 and 12,000, and occasionally as high as 14.000 feet. It is deeply intersected by streams. The rainfall is from 20 to 30 inches, most of which comes during the last two months of summer, in the form of thunder-showers, while the beginning of the growing season in spring is very dry and unfavourable to tree growth. Early frosts in autumn and late frosts in spring are also severe.

The area we are considering in South Africa lies between 20 degrees 30 min. and 30 degrees 40 min. south latitude, and 100 to 200 miles from the Indian Ocean. It has an average elevation of 6000 to 9000 feet, but in parts attains to 10,000 and rarely 11,000 feet. That is to say, it is five degrees closer to the equator and two hundred miles nearer the influence of the ocean than the Colorado Plateau, while the average elevation is about the same or slightly lower. Now, the sum of these differences should go to make our climate moister and more equable, and even better adapted for a dense forest cover than that of the Colorado Plateau. And such is also actually the case, for the rainfall here ranges between 30 to 40 inches, the average being variously given as 33.18 and 34.96 inches, as compared with 20 to 30 inches on the Colorado Plateau. Yet, owing to absence of forests in our section, this higher rainfall means only so much more water wasted and lost to the country. In both places the rain falls mostly during the second half of the summer, and in the form of thunderstorms, while

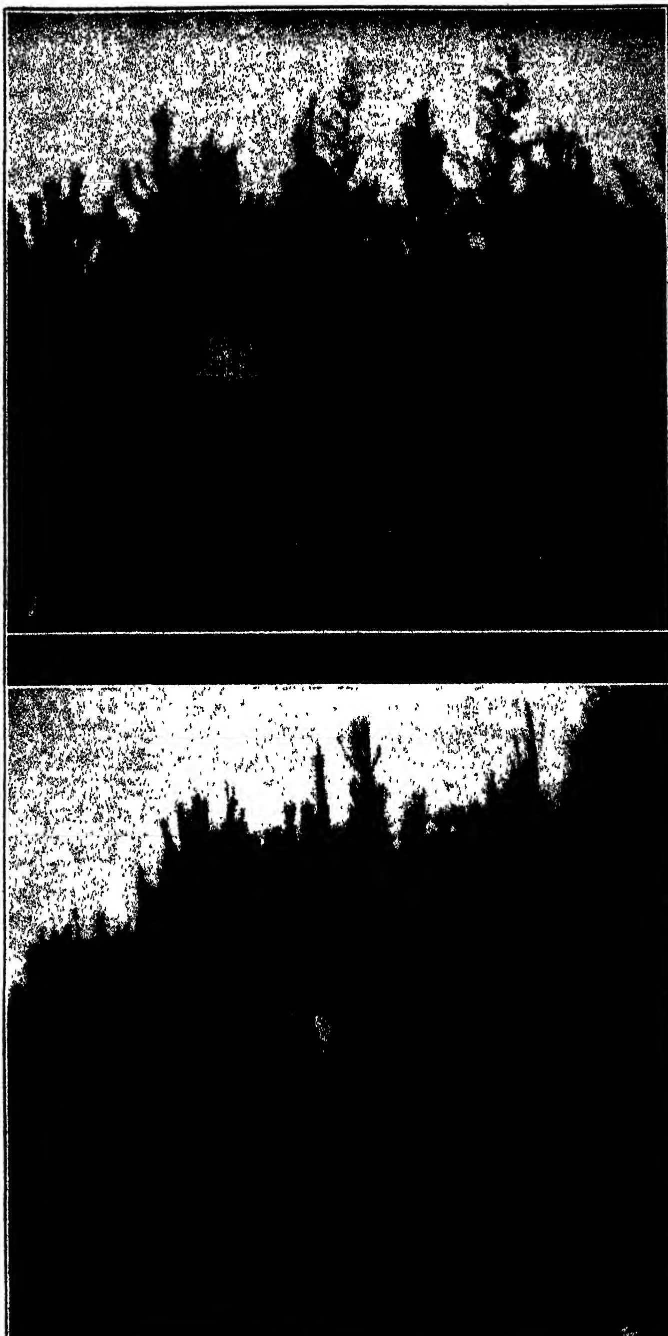


Plate No. XIII.

1. **Mixed Lusitania, Cypress, and Cluster Pine, age 5 years (Harrismith).**
2. **Cluster Pine sown *in situ*, age 6 years (Harrismith).**

the spring months are particularly noted for being dry. I have no figures at hand of the extremes of temperature in the Colorado Plateau, but it is safe to say that they are more pronounced than with us.

Our examination, then, of the climatic conditions in these two regions discloses not only their remarkable resemblance, but that any differences are distinctly in favour of our own locality.

Western yellow pine has been experimented with in the eastern Free State during the last five or six years, and gives great promise of success in our central section. But, owing to the conditions being more favourable there than in the Colorado Plateau, we are not restricted to the choice of a single species, and by judiciously mixing several kinds we are able to get superior results both in the moisture-holding capacity of the leaf-mould and in the quality of the timber grown.

The accompanying photographs taken at the Harrismith Government Plantation, where the general conditions are similar to those in our central section, except that the average rainfall is between 6 and 8 inches less, may help to illustrate the contention that practical results attained during the past five or six years go to confirm our view.

The present is neither the time nor the place to enter into a technical discussion of an afforestation scheme. Suffice it to say that, having regard to experience generally in South Africa in the past thirty years, and more particularly to the local knowledge gained during the last eight years in the eastern districts of the Free State, at altitudes ranging from 5000 to over 7000 feet, and including a wide range of experimental work over some 4000 acres of plantations, we need fear no obstacles in the execution of the work that cannot be surmounted. There are, however, other practical issues of very great importance which must be taken into consideration.

It is an established and incontrovertible axiom all the world over that extensive forest tracts, especially of the nature here proposed, can only be safely and economically managed by the Government of the country. This is partly due to the extent of the investments involved, and partly to the long period over which they are spread, but, above all, to the far-reaching national issues that are involved, the regulation of which requires the application of a steady, persistent, clear, and far-sighted policy, based on unswerving continuity of purpose. It follows as a matter of course that a scheme such as here proposed must be carried out by Government.

By far the larger area of our central section falls within Basutoland, a comparatively small portion being situate in the eastern districts of the Free State.

In 1908 the Basutoland Government, desiring to take some action in regard to afforestation, mainly with a view to check and counteract the constantly spreading donga evil, engaged the services of Mr. A. W. Heywood, then Conservator of Forests, Kingwilliamstown, to report on the whole question of afforestation.

In his report, Mr. Heywood says that the industrial timber required by the population is small, but he emphasizes the need of wood for fuel to replace the burning of dung. He also lays stress on the climatic influence of forests, and, above all, on the importance of arresting dongas. The total area of the country is about 6½ million acres, of which he estimates that the lofty ironstone Maluties cover

about one-half. He further points out that these mountains are practically uninhabited on account of the inclemency of the climate, that every acre of land that can be cultivated seems to be worked, that occupation of the inhospitable mountains is being forced on the people by pressure of increasing population, and that the country is very heavily stocked with horses, cattle, sheep, and goats.

The position, then, is: Here is an area of about three million acres of uninhabited country in a neighbouring State, the afforestation of which, wholly or in part, is as much in the interest of that State as in ours. To expect a small native community to undertake a task of such magnitude is out of the question, but, as I hope to show, not so for the South African Union. Under these circumstances there would seem to be no reason why the two countries should not come to an agreement in the matter. Something further will be said on this subject when we come to consider general results. Meanwhile let us examine the financial side of the question.

IV.—FINANCIAL ASPECT.

Although the total area of the uninhabited Maluties and that portion of the Free State which was included in our central section is close on three and a half million acres, allowance must be made for a certain percentage being unsuitable and required for other purposes. Let us say that our scheme involves the afforestation of a round million acres, an area large enough to exercise a sufficiently powerful influence on water conservation to suit our purposes. The actual cost per acre will greatly depend on the scale of the annual operations. The larger the scale up to a certain point the cheaper the work. On the other hand rate of progress must necessarily be restricted by availability of labour and seed supplies. Taking into account, in a general way, our local experience in the Free State, we may say that 10,000 acres a year would be a good rate of progress. Conducted on any scale of not less than 2000 acres a year, the cost per acre should not exceed £6. Taking these figures as a basis, it will require 100 years and an annual outlay of £60,000, or a total expenditure of £6,000,000, to cover one million acres. Here we must again avoid such technical details as methods of management and other matters, but to be clear on the financial point it is necessary to roughly survey the probable returns. In doing so I propose using conservative figures in order that our estimates may be well on the safe side.

We will suppose, then, that the rate of interest on the money expended is 3 per cent., that the rotation on which the management is based is sixty years, that the final yield per acre at that age is 5000 cubic feet, and that the market value of the standing timber will then be 4d. per cubic foot. In order to simplify calculations, we will assume that the intermediate returns derived from thinnings, which will begin at twenty years from planting, and recur every ten years from then up to the final felling, will only suffice to cover cost of administration, although it may in reality be safely anticipated that this class of receipts will amount to at least double the administrative cost.

On the basis of the above figures we find that in sixty years' time the original cost per acre, namely £6, will accumulate to £35. 6s. 8d. at 3 per cent. compound interest per annum, and that the value of the standing timber will amount to £83. 6s. 8d. per acre. We may

therefore expect a net profit of £49 per acre; or, put in other words, an afforestation scheme in Basutoland of one million acres, the total cost of which is £6,000,000, if spread over a period of 100 years with an annual expenditure of £60,000, will yield an annual income of £490,000 between the 60th and 119th years, and from that time onwards of £817,000, in perpetuity, an income representing $11\frac{2}{3}$ per cent. on the total accumulated expenditure.

These figures are, as already stated, based on conservative estimates, but if, as prudent investors in a new enterprise, we deduct nearly half of our receipts on account of possible losses from fire or disease, we are still left with a profit of 6 per cent. on the capital outlay. We may assume, therefore, that the financial aspect is sound.

V.—WHAT THE COUNTRY STANDS TO GAIN OR LOSE.

Desirable as a financial profit is, it by no means represents our only or even most important consideration in the present case. Supposing we could only expect a bare return of the capital expended, or even that a loss, within limits, had to be accounted for, there are sufficient other reasons not only to justify but to compel the undertaking. Not only do we regularize the river flow by creating a natural storage of water, equal to many inches of rainfall, over an area of one million acres, thereby proportionately increasing our facilities for irrigation, river transport, and water power for industrial purposes; not only do we create a supply of raw material in the shape of 50 to 83 million cubic feet of timber a year, capable of supporting large industries that will provide occupation for an ever-increasing population; not only will we save and keep in South Africa vastly greater sums of money than those we propose to spend, and that we now pay out to other countries for the importation of wood in yearly increasing quantities, and at prices which, owing to rapidly diminishing world supplies, are advancing at the rate of about 50 per cent. in ten to twenty years; not only do we make a further large saving on account of transport from the coast by establishing our forests in a central inland position and at a high altitude; not only do we stand to gain all these advantages, but there are also certain dangers connected with inaction which may have far-reaching and incalculable consequences. I refer to the gradual but ever increasing rate of erosion progressing in Basutoland through the formation and spread of dongas. There is no need for me here to labour the question of this evil. Every member of this congress is more or less acquainted with its effects, and the insidious manner in which it spreads, first gradually, but ever gathering pace until vast proportions are reached, and finally the damage is irreparable. And what will be the result to the rest of South Africa, or at any rate that portion which is dependent on the Orange River system for its water, if the Maluties should become denuded of the soil and vegetation that now to a certain extent help to retard the torrential run-off? Obviously what we at present consider fixed conditions of stream-flow will be greatly altered for the worse. The violence of the floods will increase and the periods of normal flow so much reduced that they will almost entirely disappear. On the other hand, the periods of drought will be still further lengthened, and the amount of water in the river beds will at such times be reduced to nil, or at best to small stagnant pools in favoured spots.

For the people of Basutoland the question is equally vital, if not more so. I have referred to Mr. Heywood's remarks about there being no more room for the people in the valleys, and that they are being forced up into the inhospitable mountains. The census returns for 1911 show an increase of 16 per cent. in the population since 1904, as against 15.12 per cent. for the South African Union. The increase in cattle and horses alone, apart from small stock, amounts to no less than 111 per cent. These are significant figures in view of the problem now before us. As yet the erosion in uninhabited parts is, fortunately, limited, but Mr. Heywood tells us that the inhabited areas are furrowed with dongas, though some are still small and of recent formation. He refers to careless cultivation, annual grass-burning, and tramping out by stock as the causes of the evil, and concludes his report by saying that "it appears to be of the utmost importance that practical forestry should be applied to the arrest of dongas and ravines." There can be no doubt on that point. To the people of Basutoland afforestation does not only mean the saving of the land in the interests of the present and future population, but it also means that the industries created will enable the country to support a larger increase in the future than it otherwise would. If, on the other hand, matters are allowed to drift, the faster the population and the stock increases, the faster will the agricultural resources of the country be diminished, until the process is reversed and depopulation has to set in.

I have endeavoured to present a case of practical interest to irrigation in South Africa, not merely as desirable adjunct, but as one of vital importance to the Union and Basutoland alike. May I express the hope that it will be as seriously and actively taken up as other branches of the subject. I am aware of the difficulties that have to be overcome. To the general public forestry is too remote a subject to be considered seriously side by side with the many pressing public issues of the day. We are all enthusiastic about it in an abstract kind of way, and hope something will be done some day. If, instead of having to submit a scheme spread over 100 years, it were possible for me to say, "give me £6,000,000, and in six years I will call you to the opening ceremony; the forest will be ready and the timber industries in full swing; the water will be conserved, the stream-flow regulated, water power utilized, and river transport in progress;" if, I say, it were possible to do this, I believe all difficulties would be at an end. But such propositions are for the engineer, not for the forester. There is one great difference, however. Structures of concrete and cement are prone to destruction, and from the day they are completed the process of decay sets in. But a forest ever improves and becomes more perfect from the day of its birth, were it for thousands of years. Individual trees, like people, will pass away, but the community will remain. It is the gradual progress towards concrete results that makes us slow in taking the initial step, yet it should be the other way about when once we realize the beneficial nature of the project. The rapid manner in which the remotest sections of the earth are being opened up in these latter days for the benefit of mankind has given rise to the phrase "to think in continents." We are all desperately anxious to exploit every possible corner for the benefit of the present generation, but what of those coming after? Is it not time that we cultivated a habit of "thinking in centuries" also? After all, although it will take one hundred years

or so before the fullest benefits of the scheme here proposed are reached, every acre afforested will begin to conserve water effectively in five to ten years, and to yield a return in wood at the age of 20. The proposition is, therefore, not so remote as it at first appears. The gradual progress is responsible for the deception, and makes us lose sight of the accumulative force.

There are other ways in which practical forestry plays an important part in relation to irrigation, particularly in wind-swept localities. Time will not permit me to enter into these now, but I hope to make them the subject of a future paper, if agreeable to the members of this congress.

NOTE.—The foregoing paper was read at the recent congress of the South African Irrigation Association, held at Oudtshoorn, and Mr. Carlson forwards the following supplementary notes on the discussion which took place upon his paper:—

The main points of the discussion at the Irrigation Congress in Oudtshoorn were as follows:—

That the enthusiasm of officers of the Forest Department carries them too far. That the country cannot afford to put six millions into the Drankensberg. That the expenditure of six millions should not be confined to one spot. That foresters should not concentrate the whole of their attention on the growing of forests to the exclusion of the far more necessary work of conserving what we already have. That at Oudtshoorn, for instance, valuable land was being carried away into the sea, leaving behind only boulders and sand.

I am willing to admit the charge of enthusiasm, because without enthusiasm no forester would be fitted for his life's labour in the interest of future generations. But I must deprecate the suggestion that this enthusiasm carries him too far in the present case. There are times when the forest officer has to silently pray for protection against his friends on account of their enthusiastic utterances being ascribed to himself.

Next let us deal with the point raised that forest officers should not concentrate their labours on afforestation to the exclusion of conservation of what already exists. There has been a great deal said and written lately about conservation of the natural resources of the country, but before anything can be done in that direction it is necessary to arrange our facts in a way that we are plainly able to see the proper order of their bearing upon each other. Only by this means can we arrive at a workable plan of action.

By the natural resources of a country is ultimately understood its soil and climate, by means of which everything necessary for the existence of man on earth is produced. Under climate is, of course, included everything pertaining to the movement of water in nature, such as evaporation, transpiration, precipitation, and run-off. In order to utilize these resources it is necessary that soil and moisture should be found together in suitable proportions. It is of no use to have great stores of water where there is no soil, and the best soil is of no more value than bare rocks without moisture. Hence where the two do not naturally coexist in adequate proportions, man brings them together by means of irrigation schemes. In my paper I endeavoured to give an account of the influence of forests on the movement of water in nature. As there are cases in this country where

soil and moisture are not found naturally together, so also are there many cases of forests being absent from the localities where most needed to conserve moisture, and others where their presence may be a matter of indifference from this point of view. There are also localities where forests may even be out of place and where the soil should in preference be used for the cultivation of crops. In short, forests, like everything else, must be in their proper place. Considered in the light of conservation of soil and moisture there are three main situations to which forest growth should be confined, whether by means of protection or afforestation. Firstly, forests are required on mountain watersheds in large dense masses to check the run-off, prevent erosion, regulate the flow in our rivers, and to prevent excessive silting. Secondly, trees are required in strips, groups, and blocks along the banks of streams, water-courses, dongas, furrows, and drains to prevent erosion in hilly and open country. And thirdly, in belts and rows on the plains as windbreaks to check excessive transpiration and evaporation from our lands.

In my paper I only attempted to deal with the first of these three points, and in doing so confined myself to a single locality by way of illustration. That there are others is not disputed, but to deal with all in South Africa would involve writing a book, not a paper.

The need for a dense forest vegetation is far more urgent on steep mountain slopes than anywhere else, because it is here that the run-off is most rapid, the mechanical force of water most powerful, and the result of erosion most difficult to check when once started. When once dongas get the upper hand in the mountains they are practically impossible to stop, except at a prohibitive cost, whereas in the hills and plains even the worst cases can be profitably dealt with. If you want to get a true grasp of any subject, you must begin at the fountain head. In the case before us this is not a figure of speech, but the origin from which it was derived.

The vegetation in our South African mountains may be divided into three groups—(1) high forest and bush, (2) low scrub, and (3) grass. Let us examine to what extent these are being preserved and how far present conditions can be improved upon in the interests of irrigation.

It was pointed out in my paper that we have 1,600,000 acres of forests under departmental control. These, which comprise nearly all natural forests of importance in the country, are confined, partly to a narrow strip of coast country on the southern slopes of the Outeniqua range of mountains, and partly to the south-eastern slopes of the Amatola and Drakensberg range from the eastern part of the Cape Province through the Transkeian territories, Natal, Zululand, and the eastern Transvaal. The whole of this area is efficiently protected against fire and denudation, but in no case do these forests affect the catchment areas on which the huge inland tracts of rich soil depend for irrigation.

Next let us consider the low scrub areas, of which the Langberg, Zwartberg and Kammanassie mountains of the south-eastern districts of the Cape are typical, and which are the sources from which the Oudtshoorn and Robertson irrigation schemes derive their water. The rainfall in these parts is only about 10 inches, and afforestation is here out of the question. Protection of the natural scrub from fire is here very important, but it is a task which cannot be laid at the doors of the Forest Department, except in the few instances where small

patches of Government ground have been proclaimed forest reserves. This is a distinct case where farmers must not look to Government, but act among themselves through the local water boards proclaimed under the Irrigation Act.

Finally, we have to deal with the grass-covered mountain areas. These are found principally in the Great Drakensberg range and its offshoots. It is by far the most extensive mountain system in South Africa, and on it by far the largest percentage of prospective riparian land within the Union depends for its water supply.

We have as yet no figures from the Irrigation Department as to the extent of these areas, but I believe the Orange River system to include anything from 50 to 70 per cent. of the total area in the Union.

I have stated in my paper that any kind of vegetation, including grass, is capable, to some extent, of retarding the rapid run-off from mountain slopes. But grass cannot store water for any length of time. What little it does retain is evaporated with a few hours of wind and sun. In this respect the action of grass bears no comparison with that of forests. The latter have an enormous capacity for storing water for months and for giving it off gradually.

In the Basutoland mountains there are no forests and no scrubs of any consequence. They are entirely covered with grass which is burnt every year. Their present water-storing capacity is a very poor one compared to if covered with forest, and there is no guarantee that even present conditions will be maintained in the near future.

The Director of Irrigation himself admits that Basutoland has got into a terrible state, and that in a short time we are going to be faced with a very serious question. Since then I have the highest authority for saying that the danger is far more imminent than even I was aware of, and my attention has been drawn to the fact that during the last few years the population in the Maluti mountains has increased to such an extent that it is no longer correct to speak of them as uninhabited. That being so, what the country most needs at present is an eloquent missionary, not merely an enthusiastic forest officer.

What will happen when the grass begins to lose its hold on the soil and the mountains become furrowed with dongas? Every rain will carry down millions of tons of soil, silting up our dams and weirs, which have been constructed at great trouble and expense, rendering them useless for further storage of water. If any one is in doubt as to the prevention of silt by forests, let them compare the appearance of the pure sparkling waters emanating from the George and Knysna forests with the mud-stained and silt-laden rivers fed from our donga-scarred and tramped-out veld.

Owing to the absence of vegetation to retard the run-off, floods will be of shorter duration than they are now, and far more terrific in their force, doing enormous damage to lands and irrigation works alike. On account of the increased speed at which the water will find its way from the mountains to the sea during floods, the intervening spells of low water will be proportionately prolonged until the river actually ceases to flow during gradually lengthening periods. We are at the present time experiencing a foretaste of this. On the 5th of this month, just as I was leaving for Oudtshoorn to read my paper, I found the following paragraph in the local morning paper, headed—

"IN SERIOUS CASE.

"Aliwal North and district is seriously feeling the effects of the prolonged drought. The Orange River has fallen to almost

an unprecedented extent. Between last night and this morning the flow was 1 foot. Owing to the continued fall of the river and consequent necessity of limiting the flow of the water to the municipal turbines, the supply of water and electric current to the town has been curtailed. Water is only available for six hours daily, and no current for lighting is available until 7 p.m. and not after 10. There are no lights in the streets."

It has been shown that the afforestation of the Maluties is a sure remedy against the present and future evils above depicted which threaten the country in a very real manner. I would ask, can this object be attained by a policy of conservation pure and simple? I fear the answer must be no. Who is going to undertake the task of conserving the soil in this region? Who is to prevent the native from spreading over the mountain and disturbing its vegetation, more precious than gold? Who is going to maintain a *status quo*? And even if it were possible to do this, are present conditions such that we should rest satisfied if it is possible to improve them by economically sound means?

I am told the country cannot afford to spend six millions on afforestation on a hundred-year programme, and that we should be satisfied to conserve what we have got. Personally, I am of opinion that, even if such a scheme did not yield a penny in direct return from timber, it would be more than justified on account of its immense influence on the conservation of our natural resources. But apart from this side of the question, we can create a commercial asset which, increasing yearly in value, will in a hundred years' time have reached a capital value of at least fifty million sterling, bringing in a net cash return of not less than £800,000 per annum in perpetuity.

Let me give a few actual facts and figures to show that this statement is not the mere vision of an enthusiast. Little more than fifty years ago the timber resources of the world, derived as they were from the accumulated and almost undisturbed growth of centuries, were considered practically inexhaustible. But with the rapid increase of population and the vast development of industries within the last half-century, the position has entirely changed. During the past twenty-five years the greatest authorities of Europe and America have been conducting searching investigations, with the result that a serious timber famine is expected within the next twenty-five years. These investigations have shown that the market price for timber is advancing at the rate of about 50 per cent. in every ten to twenty years, and that the quality of deals that to-day are sold as first grade, were at one time considered second, third, and even fourth grade.

Now, what is the position of South Africa in regard to this important question? Are we prepared to meet the exigencies of such a famine when it arrives? Can we do so by confining ourselves to a policy merely of conservation of what we have already got? Of the 1,600,000 acres of forests in the Union in 1910 only about 40,000 acres had been afforested with exotic species, the rest were all indigenous growth. The latest figures available of the returns yielded by these forests are to be found in the annual report of the Chief Conservator for 1910. From these it may be gathered that while a million and a half acres of centuries old indigenous forests yielded a total return of £57,000 for the year, or an average of 9d. per acre, the income

from 40,000 acres of exotic plantations, ranging from one to thirty-five years old, but probably averaging less than twelve years, was no less than £34,000, or at the rate of seventeen shillings per acre.

It would take too long to enter into an explanation of the reasons for this difference here. Under proper management the yielding capacity of our natural forests may be greatly improved, but it is on afforestation that the country must depend for its salvation.

The value of raw and partly manufactured timber imported into the Union during 1910 was £930,039. If to this we add 5 per cent. of the total value of imported articles manufactured out of wood, as the approximate value of the raw wood material contained in them, we get a round total of one million sterling which the country paid for imported timber in that year. As against this the value of home-grown timber sold from Government forests in the same year was £22,468, or less than 2½ per cent. of the total consumption. If such is the state of affairs at the present day when the population is only one and a quarter million whites and four millions natives, what will happen in twenty-five years when we may have to provide for double or treble the present population, and when outside supplies have been cut off or can only be tapped at prohibitive rates? I leave it to the country to decide whether, under the circumstances, we can afford to spend £60,000 per annum on a hundred years' programme in order ever after to reap something like a million sterling per annum in return.

I have said that by the natural resources of a country is ultimately understood its soil and climate. Let me conclude by illustrating with a parable how these resources should be wisely treated. The utilization of our natural resources by means of irrigation may be likened to the growth of a tree. Our mountain watersheds are the roots of the tree, our rivers its stem, our arable lands its branches and leaves, and the crops we reap its fruits. Each part has to be kept vigorous and healthy, that a proper yield may be gathered, but above all, the root system. If that is neglected and starved, or allowed to become diseased, then the whole tree will wither and eventually perish. If properly tended and cared for it will nourish and invigorate all parts of the tree and enable it to bear the most glorious fruit.

The Preservation and Use of Maize for Stock Feed.

By JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

(Continued from Page 88.)

MAIZE GRAIN FOR STOCK FEED.

THE value of maize grain as an addition to veld grazing, veld hay, or other roughage is not yet fully appreciated in South Africa, though its use is increasing. Some farmers, it is true, have gone to

the other extreme and have argued that because maize is a good food it may be given almost exclusively, but this is by no means the case. The grain, alone, is not only too concentrated for a ration, but it contains too high a percentage of carbohydrates (fat formers) to be used by itself. And in any case a mixed ration is more suitable and more economical.

But, as Henry has well said, "Let us not despise maize because, when wrongly and excessively used, . . . it failed to develop the normal framework of bone and muscle. Each feed has its function in the nutrition of animals, and only by its abuse can unfavourable results follow. This grain has enabled the United States to take first rank among nations in the quantity of pork produced, and upon its judicious use rests future success."

Hunt points out that in America, the home of maize, the chief use of the maize crop is as food for domestic animals. "In connection with grass it is *the* meat-producing material of the United States. The wonderful development of our pork industry is directly related to our maize crop. . . . The ears of maize are the natural food of the civilized hog. . . . The digestible nutrients in the grain and stover are about as two to one. The proportionate food value, however, is greater in the grain on account of its greater net available energy."

The leading characteristic of maize grain is the large proportion of starchy matter, coupled with the rather low protein content and a low percentage of ash. Compared with wheat, maize has somewhat less carbohydrates, less protein, but more oil. Rich in starch and oil, the function of maize is plainly to produce heat and fat, when fed to farm animals. *For fattening purposes,* Henry says, *no other grain equals maize.* But lacking in protein and ash it is not so well suited for the production of bone and muscle in young and growing animals.

In feeding whole grain to cattle some of the grain will pass through the alimentary tract undigested. The Wisconsin Station (Report, 1892) found that over 18 per cent. of the maize fed as dry grain, but only 3 per cent. of the grain from the silo, passed through cows in unbroken form. The Kansas Station (Bulletin No. 47) found 11 per cent. soaked maize and nearly 16 per cent. whole and broken dry maize passed through steers. This grain need not be wasted if vigorous young pigs are given the opportunity of searching it out among the droppings. It takes twenty-one to twenty-four hours for the grains to pass through a steer (Kansas Station Bulletin No. 47). The dry grain voided by steers does not become fully saturated, although it has passed through the whole length of the alimentary canal.

GRAIN AND PASTURAGE.

Where the natural pasturage runs short in summer and the lack of food, together with flies and heat, are reducing gains in condition already made by slaughter bullocks, Henry recommends that feeding with maize grain should be practised. The feeder begins by supplying about a peck (14 lb.) of maize per head, increasing the amount by midsummer to fully ⅓ bushel (18½ lb.) daily, for grown bullocks. The maize is dealt out once a day in a feed box in the camp. Pigs are allowed to follow to save the waste. "Instead of giving maize only,

it is better, when possible, to substitute 2 or 3 lb. of oil-meal or bran for the same weight of maize. The feed should always be supplied at the same hour. Where maize is fed not over half the usual area of pasture land is required. Pasture-fed steers eat about as much grain as if confined to the feed-lot."

J. D. Gillett, the great Illinois steer feeder of the last generation, is quoted by Henry as having said that he could not afford to fatten steers in winter. His cattle were fattened in the summer and fall, subsisting in winter in the maize stalk fields and on the dry grasses of the pastures. In summer they luxuriated in rich old blue-grass pastures where the feed boxes always stood loaded with grain. The great success of this feeder is sufficient evidence of the wisdom of his practice, with the conditions and markets then prevailing, i.e. good prices for well-fattened cattle.

Wallace, in summarizing the experience of numerous cattle feeders in the Western States, writes:—"The general opinion seems to be that good steers fed grain or grass will gain from 75 to 100 lb. per month, and that steers on good pasture will, during the two or three most favourable grazing months, gain almost as much on grass alone. . . . From all the facts I have been able to obtain I am inclined to the opinion that in general there is not much money in feeding grain to steers that are on full pasture of the best kind" (Live Stock Report, Chicago, 3rd June, 1892).

"Where pastures carry a sufficient growth of (nutritious) grass for full feed, even during midsummer, it is usually best to allow the cattle to subsist entirely on natural herbage, for this is of low cost, and animals relying upon their own exertions gather their food vigorously and willingly, wasting no time in standing idly waiting for food" (*Henry*).

Transvaal sheep farmers have found it useful to give about ¼ lb. of maize grain per sheep per day during the winter months to those animals which are not sent down to the bushveld. To prevent the sheep stealing too much from one another some farmers scatter the grain broadcast over the veld so thinly that they have to hunt around for it. Some farmers tell me that this makes the sheep lazy, inducing them to lie round the feeding place awaiting the arrival of the grain cart instead of hunting for pasturage. To avoid this they have adopted the practice of scattering the grain at different places on the veld on succeeding days. Some farmers feed maize to their rams in troughs in a shed near the kraal before they are turned out into the veld in the morning.

For pigs running on blue-grass pasture the Illinois Station (Bulletin No. 16) found that the best returns were secured when giving a half feed of maize grain during the first eight weeks, then following for the next four weeks with a full feed of maize, the pigs still running on pasture. Where a full feed of maize was given for the whole period a much larger amount of maize was consumed for an equal gain in weight. "There was a saving of 30 per cent. when a half feed of maize was given on pasture, and of 20 per cent. when a full feed was given, as compared with feeding hogs in the lot without pasture" (*Henry*).

A saving of feed is effected by allowing pigs to follow steers feeding on maize or mealie meal. Henry found this to amount to 52 per cent. in the case of maize and 3 per cent. in the case mealie meal over the amount required to feed pigs in the pen. The amount

of maize required to produce 100 lb. grain was found by the Illinois Station to vary from 333 to 808 lb., with an average of 534. The average daily gain was about 1.1 lb. Eleven pounds increase, live weight, is considered in the States to be a satisfactory return from a bushel (56 lb.) of maize.

"One mistake that is sometimes made is turning on pasture steers that have been heavily grained during the winter. This is usually a losing operation, and the more radical the change from the dry lot to the pasture the greater will be the loss" (*Pacific Rural Press*, 9th June, 1906).

FEEDING MAIZE ON THE COB.

Where labour is scarce and high-priced, and maize is cheap, it is found economical to feed the grain on the ear without even husking it. The simplest way is to use maize direct from the shock, throwing the long stalks, with the ears attached, into the mangers. The cows first pick out the ears, and after eating these finish off the leaves and then the stalks. "By supplying maize on the stalk for the evening feed so as to allow the cows a long period for working them over, all will be consumed before morning except some of the coarser portions of the stalks, thus reducing the labour of removing the waste. Dairymen generally prefer, however, to run their shock maize through the feed-cutter or shredder, which leaves the material in a form relished by the cow and easily handled; the broken ears of maize are then easily masticated, the cobs also being consumed."

But in feeding in this way care should be taken to obtain a fairly close estimate of the proportion of grain to roughage. By selecting an average shock, husking out the ears, and ascertaining how much shelled grain it carries, the amount which should be fed can be determined.

Although the maize cob (i.e. after the grain is shelled) consists largely of crude fibre, and therefore has a low feeding value, it can be used to advantage for stock-feed under certain conditions. If the grain has not fully ripened, the cob is less hard and woody, and contains more nutriment, and such cobs are readily eaten by cattle, provided no deleterious fermentation or fungous growth has developed. As a result of experience and observation, many cattle feeders find it advantageous to use this otherwise waste product by feeding the whole ear, i.e. cob and grain together (*Henry*).

"The practice, common in the corn-belt, of supplying unhusked or unground maize to steers, has developed the feeling among eastern feeders that the method is wasteful, and could be immensely improved by grinding the grain." Henry combats this idea: "No one," he says, "can study the western situation without becoming impressed with the belief that the better class of these (western) feeders are, after all, about right in this practice. Maize," he adds, "is never so acceptable to a steer as when in the husk. There is a freshness and palatability about an ear of corn wrapped in Nature's covering which every steer recognizes and shows by the eagerness with which he consumes it.

"*Snapped corn*, i.e. ears severed from the stalks but still wrapped in the husks, is successfully used for steer feeding.

"In general, directions for feeding cheap maize may be summed up by the single statement: Let the feeder supply this grain to his cattle in the most inexpensive manner possible so long as they consume full rations without difficulty in mastication."

The Texas Station (Bull. 2) made a saving of 3 per cent. by feeding both cob and husk with the grain. The husked ears were ground coarsely.

FREQUENCY OF FEEDING GRAIN.

"It is reasonable that all young animals should be fed at least three times a day, while those approaching maturity and not heavily fed are amply provided for in two feeds.

"Maturing cattle prosper, and perhaps do their best, when supplied grain but once a day. The once-fed steer goes to the trough with paunch well emptied and appetite at the best; filling himself to the utmost, he has ample time for rumination and subsequent digestion" (*Henry*).

PREPARATION OF GRAIN FOR FEEDING.

In the dry interior districts maize on the cob stored in the hock becomes very hard and dry, the moisture content falling from 20 per cent. to 10 or even 9 per cent. In this condition it may hurt the mouths of animals in the process of mastication. With some breeds of maize the large size of the ear makes it difficult to get it into the mouth. In such cases some form of treatment before feeding may be found necessary. The methods usually practised are (1) to break the ears with a hatchet in the feed-box into three or four pieces—this is somewhat crude, but simple; (2) to run the ears, with or without the husks, through a crusher, which reduces them to a reasonable degree of fineness, breaking the cobs into many pieces and cracking some of the grains; (3) to soak the grain, which enables the animal to crush it more easily, and often to consume a larger quantity; (4) grinding into "corn and cob" meal, or shelling and grinding into mealie meal.

DRY *versus* SOAKED MAIZE.

Soaking the grain renders it more easily masticated, but apparently less digestible owing to decreased secretion of saliva.

In Germany a trial was made of the comparative feeding value of dry and soaked maize. Twenty sheep, nearly two years old, were fed 1.4 lb. of whole maize grain per head per day, ten receiving the grain dry and ten receiving it soaked with as much water as it would absorb. This was continued for fourteen weeks. At the end of the trial the lot which had received dry grain had increased 12.1 lb. per head more than those which had the soaked grain. The investigators conclude that the poor results obtained from the soaked grain are due to decreased secretion of saliva (Mueller in *Braunschw. Landw. Zeit.*, 1885, p. 209; *Jahresb. Agr. Chemie.*, 1885, p. 576).

Wolf (*Landw. Jahrb.* 16, 1887, Sup. III, p. 21, quoted by Henry) found that in the case of healthy horses with good teeth the utilization of beans and maize remained about the same, whether fed whole and in dry condition, or after having been soaked in water for twenty-four hours, care being taken in the latter case to guard against loss of nutrients.

Experiments at the Kansas Station (Bull. 4) showed that steers fed with soaked maize did not consume quite as much as the other lot, yet made a better gain; there was a saving of 15 per cent. by soaking shelled grain. Where, however, pigs followed the steers, and got more than one-half of their feed from the droppings, the

droppings from the steers which had dry maize gave the best results, and the saving by soaking was only 5 per cent.

CORN AND COB MEAL.

The unshelled ears of maize are in many cases ground up with the cob. The resulting product is known as "corn and cob meal." The cob contains very little nutriment, but mixing with the meal it helps to lighten up the latter and render it more easily digestible. The following comments indicate the value of the mixture:—"Practical experience is strongly in favour of using the cob with the grain when feeding meal to farm animals." "Corn and cob meal has been found very satisfactory by feeders, the animals not getting 'off feed' so easily as when pure meal is fed." "Stockmen quite generally report favourably on its use." "It will be found satisfactory for dairy feeding, and is recommended whenever it is possible to secure it at not too great expense for grinding." "For horses it is preferable to pure maize meal . . . on account of its higher percentage of cellulose which renders it more like oats."

For dairy cows the Ohio Station tested its value when fed with hay, as compared with ear maize, with satisfactory results in favour of the corn and cob meal.

For fattening bullocks, the Kansas College of Agriculture found that it gave a better daily gain than mealie meal, and that a pound of corn and cob meal is equal to a pound of pure mealie meal in feeding steers (Reports of Professor of Agriculture, 1884-85).

In trials at the New Hampshire and Kansas Colleges of Agriculture, corn and cob meal proved superior to the same weight of maize meal for pigs; at the Missouri College, however, it required very much less maize meal than corn and cob meal to produce 100 lb. gain in weight (New Hampsh. Board of Agr. Rpt. 1880, pp. 259-262; Missouri Coll. of Agr. Bull. 1, 1883; Kansas Coll. Rep. 1884).

Experiments conducted by the Paris Omnibus Company showed that it proved more acceptable than pure mealie meal (Pott, Fuhling's *Landw. Zeitung*, 1893, p. 483). As the amount of nutriment in the cob is small, it is not easy to understand why this compound meets with general favour, especially as the cost of grinding is considerably increased. It has been suggested that the meal itself is too concentrated, lying heavily in the digestive tract, and while in this state is not so easily penetrated by the digestive substances, whereas the particles of cob mixed with the meal keep it looser and in a condition to be more easily digested.

Some difficulty is experienced in grinding the cob sufficiently fine owing to the power required; if left too coarse the animals usually pick out only the meal and reject the pieces of cob.

MAIZE COB CHARCOAL.

"Where maize cobs are burned for fuel, in the prairie districts, the ashes should be saved for the pigs."

Maize cobs are plentiful in many parts of the country. Henry states that where pig-feeding is largely practised they can serve no better purpose, as far as needed, than in producing charcoal for use in the feeding pens.

"The following directions for reducing maize cobs to charcoal are given by Theodore Louis (*Farm, Stock, and Home*, 15th July, 1894),

a breeder of high repute in the north-west:—'Dig a hole in the ground 5 feet deep, 1 foot in diameter at the bottom, and 5 feet at the top, for the charcoal pit. Take the maize cobs, which should have been saved in a dry place, and starting a fire in the bottom of this pit, keep adding cobs so that the flame is gradually drawn to the top of the pit, which will thus be filled with the cobs. Then take a sheet-iron cover similar to a pot-lid in form, and over 5 feet in diameter, so as to amply cover the hole, and close up the burning mass, sealing the edges of this lid in turn with earth. At the end of twelve hours you may uncover and take out a fine sample of corn-cob charcoal.'

"Charcoal so produced may be fed directly or, better still, compounded as directed by Mr. Louis in the following manner:—

"'Take six bushels of this cob charcoal, or 3 bushels of common charcoal, 8 lb. of salt, 2 quarts of air-slaked lime, 1 bushel of wood ashes. Break the charcoal well down with shovel or other implement, and thoroughly mix. Then take 1¼ lb. of copperas and dissolve in hot water, and with an ordinary watering-pot sprinkle over the whole mass and then again mix thoroughly. Put this mixture into the self-feeding boxes, and place them where hogs of all ages can eat of their contents at pleasure.'"

MAIZE MEAL.

Mealie meal is a somewhat heavy, rich feed, which is apt to induce indigestion and other troubles if fed alone. "It should always be lightened or extended by the use of bran, shorts, oil meal, or some other feed of light character . . . in which case the dangers incident to its use are usually overcome." The dry meal is unpalatable, and should be soaked with water before feeding *(Henry)*.

For dairy cows.—The Maine Station (Report, 1895) tested maize meal for dairy cows, as compared with wheat meal. Making allowance for normal decrease in milk-flow with the lengthening of the lactation period, the results were practically equal.

For bullocks.—Trials at the Stations show that maize meal gives larger gains with steers than the same weight of unground grain. It is probable also that meal permits of a higher finish with steers than unground maize. But practical experience and studies by the Stations show that pigs following steers fed maize meal got very little from the droppings; not because such droppings are without nutriment, but rather because the meal in the droppings is in a form which cannot be utilized by the pig. Henry therefore concludes that where maize is cheap, and there is a demand for pork, the western custom of feeding maize whole to steers, with lively shotes following, is the most economical, all things considered, if rationally practised.

The Kansas Station (Bull. 34 and 60) tested the value of maize meal as compared with ear-maize for feeding steers. The steers fed ear-maize gained somewhat more than those fed maize meal, but they required 6 per cent. more grain. "This is not a very favourable showing for maize meal, and I confess the result is contrary to my expectations. A considerable percentage of the whole maize passes through the animal undigested, and it would seem that the digestive juices could act to better advantage on the pure maize meal than on the partially masticated grains of maize, and extract more nourishment from it, but apparently this is not the case"

(*Georgeson*). "In the second trial there was a saving of 35 per cent. of the maize by grinding, which may be regarded as the extreme saving possible in such feeding. This result is the largest saving of grain by grinding yet reported by any of the Stations so far as the writer is able to learn" (*Henry*).

For pigs.—Henry made a careful test with 70 pigs to determine the relative value of whole grain and meal; the maize used was a yellow dent containing about 12 per cent. moisture. In three out of four trials the mealie meal was more economical than whole maize; a saving in weight fed of 8 per cent. was effected by grinding (p. 557). Tests conducted at the Kentucky, Ohio, and Missouri Stations, with only 2, 3, and 4 pigs in each lot (26 in all) showed a saving of only 2 per cent.; but Henry quotes the experiments of several stations which show that maize meal is of practically equal value with wheat meal for feeding pigs. His own experiments show that a mixture of wheat meal and maize meal is superior to wheat meal alone for feeding pigs, resulting in a saving of 3 per cent. in weight of material fed. He points out that while larger returns can be secured from mealie meal than from whole grain, it has several disadvantages in practical use. Towards the close of the fattening period it is especially useful in giving more finish.

For lambs.—Experiments at the Wisconsin Station show that mealie meal can be used satisfactorily for fattening lambs; it proved a more economical food than in combination with oats or peas before weaning, and of equal value to these combinations after weaning (Wisconsin Rep. 1897). Henry concludes that it is probable that mealie meal will force the largest and most economical gain with lambs both before and after weaning, the protein required being obtained from the mother's milk and pasture grass respectively. It is not prudent, he adds, to use maize alone for ewe lambs which are to be used later for breeding purposes, for this grain builds fat and not bone and muscle (*Feeds and Feeding*, p. 510). Craig found that mealie meal was more economical than oats, wheat, bran, or cracked peas for feeding slaughter lambs before weaning; it took 86 lb. whole oats, 77 lb. wheat bran, 73 lb. cracked peas, and only 63 lb. of mealie meal to produce 100 lb. gain in weight; the weekly returns were as good (Wis. Rep. 1897).

The Wisconsin Station also made a comparative test of feeding lambs with and without grain before weaning, with the result that those which received grain continuously from birth until 10 months old sheared a heavier fleece containing more yolk or grease, and matured much earlier than those without grain, and were fit for market at any time, so that advantage could be taken of any favourable fluctuation in market prices (Wisc. Rep. 1896).

(To be continued.)

Forestry in the Free State.

By K. A. F. Carlson, Conservator of Forests, Orange Free State Conservancy.

There are no natural forests in the Free State beyond some open savanna scrubs, mainly composed of various species of the mimosa family, thickets of native willows, etc., along the banks of the more permanent streams, and scattered specimens of olive, kareeboom, camdaboo-stinkhout, salie, etc., on the sides of kopjes. Nor is there any indication that any true forest growth, viz., more or less densely growing large timber, has ever existed within the present geological era.

From these circumstances, and from the severe climatic conditions of the country, it is sometimes argued that economic timber growing is not a practical proposition.

When, therefore, Mr. H. F. Wilson, C.M.G. (now Sir Harry Wilson), while Acting Lieutenant-Governor of the Orange River Colony in 1903, took steps to introduce forestry as part of the Government policy for the resettlement and benefit of the inhabitants of the country, few people looked upon the movement as anything more than a passing fad.

In most cases the meaning of the word "forestry" was not understood. In towns it was confused with the idea of parks and landscape gardening, and in the country when it was explained to mean the growing of trees for timber purposes, many people objected that trees obstruct the view, and attract birds, ticks, and stock diseases, while under no circumstances would they grow except under irrigation.

Looking back it may be conceded that considering certain climatic drawbacks and how little was known locally about the selection of suitable trees and their proper treatment, the pessimism of the many is not so much to be wondered at as the optimism of the few.

From what has been said, it will readily be understood that forestry in the Free State must for a time continue to be of a creative character, there being no indigenous forests on which to draw for supply or from which to secure a revenue. And as this fact at one and the same time affords arguments both for and against the maintenance of active forestry operations, this article will to a certain extent take the form of a vindication.

In 1904 the forest policy of the Free State was declared to have two objects in view, both of which have since been steadily maintained so far as circumstances have allowed. These objects were:—

(*a*) To establish plantations of locally grown timber to meet future requirements of the Colony.

(*b*) To encourage and facilitate tree planting by farmers and others for shelter to stock and crops, the protection of the soil against erosion, production of small timber for general use on the farms, and, lastly, for aesthetic purposes.

As already stated, everything had to be started from the very beginning. The Free State had just emerged from being the

principal scene of a devastating war, which added considerably to the expense and difficulty of the conduct of all operations, while the climatic conditions were unfamiliar to those responsible for the scheme, a difficulty which was accentuated by exceptional droughts during the first few years.

Taking all these circumstances into consideration it naturally follows that, although based on a definite policy, the operations were bound for some years to be of a purely experimental nature.

The Free State is an inland plateau, the altitude of which averages from 4000 to 6000 feet above sea level, with scattered kopjes which towards the eastern districts become more numerous until they connect to form ranges of hills along the Caledon River, and occasionally rising to 7000 or 8000 feet.

These ranges are composed principally of sandstone with more or less frequent outcrops of ironstone, but westward the sandstone gradually disappears and the kopjes mainly consist of ironstone. In the eastern districts the soil ranges from clayey to sandy loams of varying depth. In the northern part of the midland districts there are tracts of heavy black turf on shale intermixed with sandy soils. In the extreme north and north-west, deep sandy loams predominate, interspersed here and there by tracts of red soil. In the southern half of the midlands the red soil which is due to ironstone formation is more frequently found, and the purely sandy soil and black turf less so, and the soil is here more frequently of a calcareous nature. The western and south-western districts are principally characterized by the calcareous nature of the soil. In parts there is only a shallow layer of loam on top of solid limestone, but the latter is often covered by a sandy or a red loam of considerable depth. In these districts brak is very frequent in the form of pans of which there are thousands of various sizes.

The average annual rainfall varies from about 18 in. to 23 in. in different parts of the western districts, from 20 in. to 26 in. in the midlands, and 25 in. to 30 in. in the eastern districts.

About 15 per cent. of the rain falls during the three months August to October, and 57 per cent. during four months, December to March, and 76 per cent. during six months, November to April; the fall in May, June, and July being as a rule negligible.

The mean relative humidity (taken from three years' observation only) ranges from 42 to 96 per cent.

The mean monthly temperature ranges between 42 degrees and 52 degrees Fahrenheit in winter, and between 63 degrees and 75 degrees in summer. Actual minima on winter nights not infrequently reach 12 degrees or even lower, while on summer days the temperature often rises to 98 degrees or higher. In winter the difference between night and day temperature is frequently 30 degrees and sometimes 50 degrees.

Dry westerly winds prevail, especially during spring and early summer, but cold southerly winds are frequently experienced in winter and spring.

Judging by the distribution of the average rainfall figures it would seem that a continuous planting season for evergreen trees may be expected from November to April. As a matter of fact this is never the case, for the rain falls in heavy storms between which are long intervals during which evaporation and transpiration are very heavy, and great precautions have to be taken to retain sufficient

moisture in the soil to allow the young trees to establish themselves. From February the extent of the evaporation begins to decline, and it is only in exceptional seasons that it is safe to begin planting earlier than that unless watering can be depended upon, and not infrequently planting has to be deferred as late as March and April or even May.

Frosts begin in April, but the regular cold season sets in during the latter half of May, and the young plants have therefore a very short time to become established before they must encounter very severe cold and drought. Owing to the rapidly increasing rate of evaporation during spring and early summer, due to dry winds and increasing temperature, the rain which falls during this period is rarely of any great value so far as tree growth goes, and planting during this period should be strictly avoided, except on a small scale, and where large strong plants can be used and frequently watered until the late summer rains have set in.

During the eight years ended 31st December, 1911, a sum of £55,000 was spent on nursery and plantation work at the Government stations in the Bloemfontein, Thaba 'Nchu, Ladybrand, Ficksburg, Harrismith, and Kroonstad districts, an average expenditure of slightly over £6000 per annum. In the same period the revenue derived from these operations amounted to £20,000, mostly from the sale of transplants.

While variation in expenditure from year to year has been only slight, the results have steadily increased as preliminary operations have been concluded, experience gained, and the general conditions of the country become more settled. For instance, of the 2825 acres now planted with timber, 92 acres were covered the first year, and 825 acres in the last, while out of the total of 10¼ million trees planted and disposed of, 148,000 were accounted for in 1904 and 2,574,000 in 1911.

The trees that have so far been proved suitable for growing in various localities for timber, shelter, and other economic uses include 15 species of eucalyptus (gums), 26 species of conifers (comprising pines, cypresses, cedars, junipers, thuya, callitrises, and casuarinas), 4 species of acacias (wattles), 34 deciduous species (oaks, robinia, willows, poplars, elms, ash, chestnut, catalpa, gleditschia, tamarix, plane, mulberry, osiers, etc.), and a few miscellaneous kinds. In addition to these, some 65 other species, mostly belonging to the above groups and families, are still under trial.

One very important field of operations undertaken in the Free State is the experimental mixing of species for the improvement and maintenance of soil conditions, protection of the crop against fungi and insect pests, and the consequent production of superior timber, and safer returns. Many of the results attained so far are very promising, but ultimate success must largely depend on correct treatment of thinnings.

It has already been mentioned that because the natural tree growth of the Free State takes the form of open savanna forests and of scattered individual trees, the opinion has sometimes been expressed that a higher grade of forestry of an economic order is not possible. As a rule, however, the critics do not speak from personal knowledge of the Free State. The contention is, moreover, beside the mark, seeing that trees of the same kinds (mimosa, etc.) grow in open scrub at the coast as well as inland.

Some critics believe that, except for the eastern localities with their heavier rainfall, the Free State can only be expected to grow fuel and small wood for such uses as fencing. After eight and a half years' close investigation of the local conditions of the various parts of the Province, of practical experiments conducted on a fairly large scale, and a careful study of exotic trees planted twenty to fifty years ago, there is no reason to doubt that it is the area of the Free State unsuitable for the growth of trees which is the smaller, and not the area which is suitable.

In countries with a high percentage of relative air humidity throughout the year, and a well distributed rainfall of, say, 20 in. or more, economic forestry is practicable even on very shallow soils, but under conditions such as those which rule in the Free State the presence of sufficient depth of soil to maintain sub-soil moisture during exceptional drought is of the first importance. For shelter purposes it is not always possible to choose the most favourable sites for the best kinds of trees, but there are few situations so unfavourable that they do not admit of some kind of trees being grown for that purpose.

So far from the eastern districts being the only part suitable for timber production there are large tracts throughout the midlands, but particularly in the north-western and parts of the western districts, with deep porous sandy soil where the more valuable inland timber gums (eucalyptus) give promise of better results than in the higher altitudes and colder soils of the east.

As regards size of timber it is not claimed that the Free State will produce giant trees, but there is every reason to think that it can and will produce commercial timber representing 95 per cent. of the ordinary requirements of the country.

The Prynnsberg plantations, the property of Mr. Charles Newberry, although planted and treated for ornamental, shelter, and landscape effect, afford a very good illustration of the prospects of economic timber culture in the Free State. The older parts of these were planted twenty-five to thirty years ago, and timber cut from them is now being put to a great many useful purposes.

On the Vereeniging Estates over 2000 acres, mostly of pines and oaks, have been planted to timber during the past fifteen to twenty years. Some years ago an oak tree, forty-three years old, was cut down on this estate and part of the timber sent to Germany to be tested. It was pronounced equal to the best quality oak timber produced in Europe.

At the Central Agricultural Show, held in Bloemfontein in April, 1912, there was exhibited a number of specimens of timber, consisting of gums, pine, oak, robinia, and others from trees grown in the Free State, and this exhibit indicated not only the large size attainable, but the good quality of the wood and the excellent manner in which it can be seasoned, in spite of the fact that in some cases the timber was cut from more or less isolated and exposed and therefore knotty trees.

Although it may be admitted that average situations in the Free State will probably yield a smaller return of cubic feet per acre than more climatically favoured coast districts, this return is likely considerably to exceed that of the largest timber exporting countries of Europe, on which we depend at present for supplies.

From a financial point of view the return per acre in the Free State should be at least equal to that of coast plantations in view of the cost of transport and the absence of any other local sources of supply. So far as it has been possible to investigate the matter it seems probable that timber grown in the Free State climate is likely to season more readily than that grown in the coast regions.

To grow fairly large timber of good quality, and in sufficient bulk to meet the requirements of a country, requires the locking up of a large capital for too long a time to appeal to or to be safe in the hands of individual investors, and is essentially the business of the State. But in an open country of exposed rolling planes, with a scorching hot sun in summer, and bitterly cold winds in winter, belts and clumps of trees for shelter to stock, crops, orchards, and dwellings are fast becoming recognized by the Free State farmer as absolute necessities, if he is to succeed in acclimatizing improved breeds of stock. During the eight years ended 31st December, 1911, a total of 3¾ million trees were disposed of from the Government nurseries for these purposes, the output commencing with 66,000 in 1904 and gradually increasing to almost a million in 1911.

Seeing that the total white population of the Free State was only 142,000 in 1904 and 175,000 in 1911, the above may be considered a fair rate of progress, especially when it is remembered that any tree planting, except under irrigation, was looked upon by a majority of people as impossible at the outset.

It is also a pleasure to record the energy with which many municipalities are taking up extensive tree planting for the benefit and improvement of their towns and surroundings, and if the lead of such places as Bloemfontein, Harrismith, Ficksburg, Ladybrand, Bethlehem, and Parys is followed the day will not be far distant when the Free State will no longer be looked upon by the visitor as a barren waste, no doubt good for sheep, but not a place of beauty.

In conclusion, it may be fairly claimed that actual results have far exceeded expectations and more than justify the expenditure incurred in carrying out the policy laid down in 1904 and its continuance on an increasing ratio until the area planted to timber shall approximate to the requirements of the population, and the farms have been well equipped with shelter.

One point is, however, essential. Operations must be carried out under an intensive management on proper business principles, if economic success is to be attained.

The question of reclaiming and preventing further spread of "dongas," by which millions of tons of the most valuable soil is being carried away, is one closely bound up with forestry. It has only been possible so far to experiment to a comparatively small extent in this direction, but the results have been very encouraging and Government co-operation with farmers and others is an urgent necessity.

The following trees are recommended for planting in the Orange Free State:—

1. Trees suitable for growing on average situation with medium depth of soil.

(*a*) In all Districts.

Acacia cultriformis.	Eucalyptus melliodora.	Juniperus virginiana.
Acacia dealbata.	Eucalyptus rostrata.	Pinus canariensis.
Atriplex nummularium.	Eucalyptus sideroxylon.	Pinus cembroides.
Cupressus arizonica.	Eucalyptus tereticornis.	Pinus longifolia.

(b) In Eastern Districts only.

Araucaria imbricata.
Cedrus atlantica.
Cedrus deodara.
Cedrus libani.
Cupressus lusitanica.
Cupressus macrocarpa.
Eucalyptus coriacea.
Eucalyptus coriacea (var. alpina).
Eucalyptus viminalis.
Picea morinda.
Pinus australis.
Pinus densiflora.
Pinus excelsa.
Pinus insignis.
Pinus massoniana.
Pinus montezumæ.
Pinus montezumæ (var. rudis).
Pinus pinaster.
Pinus ponderosa.
Pinus ponderosa (var. engelmanni).
Pinus strobus.
Pinus tæda.
Pinus thunbergii.
Acer negundo.
Fraxinus velutina.
Gleditschia triacanthos.

(c) In Eastern and Midland Districts only.

Acacia baileyana.
Cupressus guadalupensis.
Eucalyptus gunnii.
Eucalyptus stuartiana.
Pinus coulteri.
Pinus sabiniana.
Thuya orientalis.
Amygdalis communis.
Castanea vesca.
Cratægus oxyacantha.
Cratægus pyrocantha.
Cratægus pyrocantha (var. lalandi).
Prunus capuli.

(d) In Midland and Western Districts only.

Callitris calcarata.
Callitris robusta.
Casuarina cunninghami.
Casuarina glauca.
Casuarina leptoclada.
Casuarina quadiivalvis.
Cupressus horizontalis.
Cupressus pyramidalis.
Eucalyptus bicolor.
Eucalyptus hemphloia (var. alben).
Eucalyptus microtheca.
Eucalyptus polyanthemos.
Leptospermum lævigatum.
Lycidum horridum.
Pinus halepensis.
Rhus lancea.

2. Trees suitable for low-lying and cold situations, with heavy and loamy soils, four feet or more in depth.

(a) In all Districts.

Atriplex nummularium.
Cupressus arizonica.
Eucalyptus melliodora.
Eucalyptus viminalis.
Juniperus virginiana.
Thuya orientalis.
Ailanthus glandulosa.
Amygdalus communis.
Cratægus oxyacantha.
Cratægus pyrocantha.
Cratægus pyrocantha (var. lalandi).
Gleditschia triacanthos.
Populus alba
Populus fastigiata.
Robinia pseudacacia.
Salix bablonica.
Salix caprea.
Salix viminalis.
Tamarix gallica.

(b) In Eastern Districts only.

Cupressus lawsoniana.
Eucalyptus amygdalina.
Eucalyptus coriacea.
Pinus australis.
Pinus ponderosa.
Acer negundo.
Catalpa speciosa.
Platanus orientalis.
Quercus pepunculata.

(c) In Eastern and Midland Districts only.

Cedrus atlantica.
Cedrus deodara.
Cedrus libani.
Cupressus lusitanica.
Cupressus macrocarpa.
Eucalyptus gunnii.
Eucalyptus stuartiana.
Pinus pinaster.
Fraxinus velutina.
Ligustrum japonicum.
Ligustrum sinensis.
Maclura aurantiaca.
Morus alba.
Populus monilifera.
Ulmus americana.
Ulmus campestris.
Ulmus parvifolia.

(d) In Midland and Western Districts only.

Cupressus horizontalis.
Cupressus pyramidalis.
Eucalyptus rostrata.
Eucalyptus sideroxylon.
Eucalyptus tereticornis.
Pinus halepensis.

3. Trees suitable for light loams and sandy soils four feet or more in depth.

(a) In all Districts.

Acacia baileyana.
Acacia cultriformis.
Acacia dealbata.
Cupressus arizonica.
Eucalyptus leucoxylon.
Eucalyptus melliodora.
Eucalyptus rostrata.
Eucalyptus sideroxylon.
Eucalyptus tereticornis.
Eucalyptus viminalis.
Pinus canariensis.
Pinus cambroides.
Pinus longifolia.
Thuya orientalis.
Ailanthus gladulosa.
Castanea vesca.
Cratægus oxyacantha.
Cratægus pyrocantha.
Cratægus pyrocantha (var. lalandi).
Melia azedarach.
Tamarix gallica.

(b) In Eastern Districts only.

Acacia decurrens (var. mollissima).
Acacia melanoxylon.
Araucaria imbricata.
Cryptomeria japonica.
Cupressus lawsoniana.
Picea morinda.
Pinus densiflora.
Pinus exelsa.
Pinus massoniana.
Pinus montezumæ.
Pinus montezumæ (var. rudis).
Pinus strobus.
Catalpa speciosa.
Platanus orientalis.
Quercus pedunculata.
Robinia pseudacacia.

(c) In Eastern and Midland Districts only.

Acacia decurrens (var. normalis).
Cedrus atlantica.
Cedrus deodara.
Cedrus libani.
Cupressus guadalupensis.
Cupressus lusitanica.
Cupressus macrocarpa.
Eucalyptus amygdalina.
Eucalyptus coriacea.
Eucalyptus coriacea (var. alpina).
Eucalyptus gunnii.
Eucalyptus stuartiana.
Pinus australis.
Pinus coulteri.
Pinus insignis.
Pinus pinaster.
Pinus pinea.
Pinus ponderosa.
Pinus ponderosa (var. engelmanni).
Pinus sabiniana.
Pinus taeda.
Pinus thunbergii.
Acer negundo.
Amygdalus communis.
Fraxinus velutina.
Gleditschia triacanthos.
Ligustrum japonicum.
Ligustrum sinensis.
Prunus capuli.
Salix babylonica.
Salix caprea.
Salix purpurea.
Ulmus americana.
Ulmus campestris.
Ulmus parvifolia.

(d) In Midland and Western Districts only.

Callitris calcarata.
Callitris robusta.
Casuarina cunninghami.
Casuarina glauca.
Casuarina leptoclada.
Casuarina quadrivalis.
Cupressus horizantalis.
Cupressus pyramidalis.
Eucalyptus bicolor.
Eucalyptus hemiphloia (var. alben).
Eucalyptus microtheca.
Eucalyptus polyanthemos.
Leptospermum lævigatum.
Lycium horridum.
Pinus halepensis.
Rhus lancea.
Schinus molle.

4. Trees suitable for dry, rocky, and shallow soils.

Cupressus arizonica.
Eucalyptus corynocalyx
Eucalyptus hemiphloia (var. alben).
Eucalyptus sideroxylon.
Juniperus virginiana.
Olea capensis.
Pinus canariensis.
Pinus cembroides.
Pinus coulteri.
Pinus halepensis.
Pinus longifolia.
Pinus sabiniana.
Rhus lancea.

5. Trees suitable for calcareous soils.

Callitris calcarata.
Callitris robusta.
Casuarina cunninghami.
Cedrus deodara.
Cupressus arizonica.
Cupressus horizontalis.
Cupressus pyramidalis.
Cupressus torulosa.
Eucalyptus hemiphloia (var. alben).
Eucalyptus polyanthemos.
Eucalyptus rostrata.
Eucalyptus sideroxylon.
Eucalyptus tereticornis.
Juniperus virginiana.
Pinus halepensis.
Pinus longifolia.
Rhus lancea.
Schinus molle.
Celtis rhamnifolia.
Gleditschia triacanthos.
Juglans regia.
Juglans rupestris.
Melia azedarach.
Populus alba.
Populus fastigiata.
Salix babylonica.
Tamarix gallica.

6. (*a*) Trees suitable for wind-breaks, from 70 to 100 feet high, not dense.

Eucalyptus amygdalina.	Eucalyptus gunnii.	Eucalyptus viminalis.

(*b*) From 40 to 70 feet high, not dense.

Eucalyptus rostrata.	Eucalyptus sideroxylon.	Eucalyptus tereticornis.

(*c*) From 40 to 70 feet high, fairly dense.

Eucalyptus melliodora.	Eucalyptus stuartiana.	Pinus insignis.
Eucalyptus polyanthemos.	Pinus halepenis.	Pinus pinaster.

(*d*) From 40 to 70 feet high, very dense.

Cupressus arizonica.	Cupressus lusitanica.	Cupressus horizontalis.
Cupressus guadalupensis.	Cupressus macrocarpa.	

(*e*) From 20 to 30 feet high, fairly dense.

Acacia dealbata.	Eucalyptus coriacea (var. alpina).	Rhus lancea.
Acacia normalis.		Schinus molle.

Inquiry into Dips and Dipping in Natal.

BEING PARTICULARS COLLECTED FOR THE INFORMATION OF THE SOUTH AFRICAN FARMER.

By Dr. A. THEILER, C.M.G., Director of Veterinary Research; and C. E. GRAY, Principal Veterinary Surgeon.

(*Continued from page 67.*)

THE EFFECT OF THE DIP ON THE ANIMALS.

Effect on Cows in Calf.—As already shown the dipping operation had only a slight deleterious effect on the pregnant cow, and from all statements received no after-effects have been noted except in one or two cases where the malpresentation of calves was connected with the plunging of the pregnant cows into the dip. There is one statement to the effect that three cows, heavy in calf, slipped their calves after dipping.

The effect on cows in milk is a decrease in the normal yield, and is said to be as much as 33 per cent. to 50 per cent. This decrease is reputed to be more noticeable in cows which are dipped for the first time than in cows already accustomed to it. The period

of decreased yield may last up to four days, although the usual period is said to be about twenty-four to forty-eight hours. Contradictory statements are, however, to the effect that in the long run a considerable increase in the milk supply becomes noticeable, and that the milking period lasts much longer. The discrepancies are apparently due to the strength of dip and the intervals of dipping observed.

Some farmers noticed a more marked decrease of milk in cows dipped on a cold or on a very hot day than any other day, and again there are statements to the effect that the long journey to the dip is responsible. The decrease is noticeable in some cattle more than in others.

There is one remark that the decrease in the milk supply after dipping is noticeable for two years, but very little after that time. The practice also exists of not milking the cow the day after dipping.

EFFECT ON OXEN.

There is an almost uniform consensus of opinion that the dipping effects oxen most, and in the opinions of some farmers this fact is the only drawback of the regular short interval dipping. Oxen are apparently not capable of doing proper work if they are dipped on a hot day; they appear to become powerless in the hot sun, and it is stated that eight dipped oxen will not pull as hard as six undipped ones. Some calculate the loss of energy to be 50 per cent. less. The oxen soon show signs of much distress, panting and grunting, the respiration is considerably increased, they show hanging out of the tongue, and it is stated that some animals died when in the yoke as a result of not being outspanned soon enough; this latter experience has been made by several farmers, and is particularly noticed during the middle of the day in summer time. Attention is drawn to the peculiarity that this distress is more noticeable on about the third, fourth, or fifth day after dipping. On a cool cloudy day no distress whatever is seen. On the other hand some farmers did not notice this distressed condition in their oxen, and say that the work was done as well as ever. A farmer states that he has never worked his oxen on the day of dipping, and consequently has never seen any distress resulting from work. There are also statements to the effect that oxen are inspanned directly they come out of the dip without any ill-effects. The majority of farmers are of opinion that accidents in oxen so liable to distress by dipping can easily be prevented by using a little care when driving them and generally by using judgment, viz., to give them a blow now and then, to outspan when too hot in the middle of the day, and eventually to place them in the shade. It seems that some oxen have been permanently injured, and farmers advise that these animals should be disposed of to the butcher after they have been fattened up. There is one statement, however, that this ill-effect wears off in about a year's time. One farmer who has oxen working in the high and low veld says that the distress after the weekly dipping is more noticeable in the cattle of the low veld than in those of the high veld. The symptoms of blowing is also occasionally noticed in cows when exposed to a very hot sun. It is said that cows also look for shade under such conditions, and for a similar reason it is advised to keep the calves in the shade; a statement is to the effect that when pure arsenite of soda alone is used the oxen do not suffer so much from the heat as when other dips are utilized.

Dipping in the weaker solution seems to affect them less than in the stronger one, but intervals of seven days in full strength dipping is not sufficient to check the distress. On the other hand one correspondent considers that the "three days' dipping" affects oxen less than a stronger dip at longer intervals.

EFFECT ON THE SKIN.

Here apparently individual susceptibility of the animal, in addition to the strength of dip used, account for lesions in the skin. A three-days' dip is said to cause an injury to the skin, whereas a five-days' may do so. Tender-skinned animals are considered to suffer most and better bred animals more than common stock, although amongst these latter there are always found some liable to blistering. A statement is made to the effect that blistering runs in families with tender skins. It is usually only after the first two dippings that lesions are found and they are said to disappear after the fourth to sixth dipping, but some farmers state that they were in possession of animals which were attacked at almost every dipping and some actually gave up dipping certain individuals on account of skin blistering and returned to hand-dressing alone. The udders of heifers about to calf and in cows in calf, and the inside of the thighs and legs, seem to suffer particularly. There is a slight scalding succeeded by a peeling off of the surface; in more severe cases a cracking of the skin becomes noticeable. In some cows the teats are apt to crack, and blistering is said to occur more frequently in frosty weather. Cattle grossly infected with ticks also show more susceptibility to severe blistering, sometimes the whole body looking scurfy. It is stated that the skin between the hind legs and in the neck of calves is particularly apt to suffer if not attended to, and if such calves are again dipped whilst in this blistered state, death usually occurs. Some farmers state that the dip blisters the skin of some cattle more particularly under the influence of a hot sun directly after dipping or when driven too hard and overheated; others blame the dip when, through frequent dipping, the liquid has become thick. In one instance the death of seventy calves is reported as a result of blistering, the farmer having to contend with East Coast fever and preferring to dip the blistered calves rather than run the risk of propagating East Coast Fever. In order to prevent any ill-effects the more sensitive parts of certain animals, such as the udder of cows and the inside of the hind legs of calves, are protected by the application of some oily substance. Regulating dipping during the cooler periods of the day, as already stated, is also intended to obviate the effects on the skin to a certain extent, and it is generally advised to begin the dipping of undipped cattle with about half the strength of the ordinary dip, gradually increasing up to full strength. One farmer states that he has lost several milch cows by beginning with too strong a dip, and another points out that short interval dipping with full strength dip will eventually kill the cattle. Some farmers state that the black-skinned animals, such as Frieslands, seem to show more skin injuries than other breeds. It is also said that scalding is more apt to occur in spring when the animals shed their hair. Horses with a nice glossy skin will look very dull for a week or two after dipping. Bulls are said to blister more easily than other stock, and animals which have to be forced into the tank are sometimes found to be more susceptible. It is also recommended to use a dip reduced in strength during the hot weather. Animals

subject to blistering are recommended to be dipped at longer intervals which should be shortened again when tolerance is established. Some farmers are inclined to blame the paraffin entirely for the scalding, and for this reason only use arsenite of soda or reduce the strength. Animals going through the Laboratory dip first of all are reputed to blister more easily, probably from taking the floating paraffin out on their coats. Careless mixing is blamed as one of the causes through not stirring up the tank before starting, the first animals going through the tank being the only ones affected. Scalding is occasionally noticed on cattle, more particularly calves, which by one or the other reasons remain longer in the dip or which by error were put through the tank twice. Farmers who spray their cattle before dipping state that they did not notice any scalding, and there are a good many answers to the effect that no skin irritation whatever is noticed in the cattle under observation. Old cows and sickly calves are also stated to be more liable. The skin irritation is also said to occur in proprietary dips and more so with some than with others. This was particularly the case with the old formula; more recent ones do not seem to blister so much or when used on fresh cattle at short intervals. If arsenite of soda is used alone the quantity of about 8 lb. to 400 gallons of water appears to be the maximum dose which causes the minimum blistering. There are, however, beasts apt to blister even with a half-strength solution. It may be concluded that the proper way to begin dipping of "green" cattle is to use for the first two dippings a half-strength dip, to increase it gradually, and in case any animals still show skin lesions, to reduce the interval of dipping until tolerance has been established. The blistered places on these "green" cattle should be dressed with oily solution before passing them through the dip. Controlling the strength of the dipping liquid with the isometer is advisable before commencing to dip.

GENERAL EFFECT.

Once the cattle are accustomed to the dip it is stated that a general all-round improvement in condition becomes noticeable, they put on a better coat, look brighter, "clean" and smooth, glossy and sleek. Calves are said to get a better coat and be better able to stand the winter if they have been dipped. A statement is made that the frequently dipped cattle do not get fat so easily as undipped ones, and again there is a remark to the effect that the improved conditions are more apparent than real, the glossy and sleek skin being deceptive. Although one correspondent admits that there is a serious pull down in condition, he says there is a 100 per cent. gain in all other respects. The greatest loss of conditions has been noticed due to the first dipping. Dipping seems to be too much of a strain on suckling calves. One instance is recorded where after dipping on a hot day (80° F. to 90° F.) the cattle go down to a spruit and stand there with the water up to their body.

In one instance a resident in Dundee District states that the eyes of cattle are affected by dipping, especially on windy days, the eyes being noticed to water after continuous dipping.

THE ROUTINE IN DIPPING OXEN AND THEIR USE.

Generally speaking oxen are dipped at the same time, except in a few cases, when one span is dipped one day and the second span the following day. In the majority of cases oxen are used for work

immediately after dipping. From dip to yoke is the rule, and some farmers state that frequently oxen are not quite dry before they are inspanned again. Again from yoke to dip is frequently the second rule, animals being outspanned without resting or cooling, and are then sent straight into the dip. Some farmers rest their oxen before or after dipping, and some do not inspan them the same day at all. It is for this reason that in weekly dipping the operation is fixed for a Saturday in the majority of cases. In a few instances one span is dipped in the morning and another in the afternoon. Some farmers *a priori* do not expect too much work from dipped as from undipped oxen, and see that they have less work by inspanning them only in the morning and late in the afternoon during hot weather. Others give them an occasional blow and others again use large spans of oxen to do the same work which a smaller span did before. Again, some farmers dip most energetically before they put the oxen to hard work and discontinue dipping during the rush of work; others again only dip when the animals show ticks. In some cases dipping at longer intervals and hand-dressing in between is adopted, and in others complete reliance is placed on dressing, although some of the advocates of this latter method state that in case of East Coast Fever they would not recommend such a practice. Where sufficient oxen are available rotation is adopted so that one span is worked one day and is rested the next day, or at least for a part of the day. It appears that the resting of oxen before or after dipping has but little influence on the working capabilities afterwards. The main point appears to be to exercise care in the working of dipped animals and to watch them especially on hot days. As regards mules, they seem to be exempted from work for about twenty-four hours after dipping.

NUMBER OF CATTLE DIPPED AND ACCIDENTS.

The total number of cattle dipped, as near as it is possible to calculate from the answers obtained, amount to 51,458 belonging to 253 proprietors. The absence of any serious accidents amongst this number is noteworthy. Those that do occur can be classified as accidents due to injuries whilst being dipped and to poisoning by the liquid. To the former belong deaths by drowning which happened in a few cases, the farmer putting it down to carelessness on the part of the attendants; injury of the back by one animal jumping on to another (deaths in calves were also caused in this way); some cows heavy in calf were reported injured and as a result aborted; broken horns occur occasionally in the crush pen, particularly when the cattle follow each other too fast; broken legs occurred in a few instances and what is thought to be dislocation of the hip or shoulder joints was reported; accidents happen occasionally with animals trying to break away by jumping over the fences or roof (dangers of this kind are obviated by higher walls); occasional straining of the hind legs is noticed if the animals do not properly clear their feet when taking the jump; rubbing the heels and hocks are often noticed when the animals slide in. Goring and poking while in the kraals frequently happen. The most serious accident reported is the loss of thirty-five head of cattle and three mules by poisoning picked up in the veld on to which a herd of sheep was allowed to go straight from the tank. Cases of poisoning also happened in the tank itself in calves which were submerged too long sometimes as a result of another beast jumping on them. It has been seen that an animal about to be dipped for

the first time will approach the liquid and take a mouthful but it usually rejects it immediately after tasting it, in other instances a few cattle actually did swallow some of the liquid. Some deaths have occurred in calves from licking spilt dry arsenite of soda or in liquid splashed out of the tank, and pigs are reported to have died from the same cause. Cows and calves are also reported to have died after drinking liquid dip out of a bucket which stood near the tank. A good many farmers take the precaution of having their cattle watered before putting them through the tank. The idea has also been expressed that since native cattle frequently attempt to drink the dip, particularly the pure arsenite of soda solution, a craving for salt is held responsible, hence the custom of some farmers to give liberal supplies of salt to their cattle, some supplying the salt at the time and others shortly before the animals are put through the tank. This craving for dip is also said to be more pronounced in cows in calf. It is frequently noticed that cattle coming out of the dip lick their noses and cows are seen to lick their dipped calves without bad results, although in other instances mortality is reported to follow this practice. The answer of one farmer was to the effect that cattle are not such fools as to drink the dipping liquid, but here also there seem to be exceptions to this rule. Accidents due to severe blistering have already been referred to, but particular attention must be drawn to the fact that under this heading are included deaths resulting from a strong dip. In some instances death occurred when the blistered animals were dipped without previously being attended to. A number of deaths already mentioned occurred in oxen whilst worked in the hot sun. It appears to us when the number of accidents are compared with the number of cattle dipped and the number of times they are dipped, that they are of a negligible nature. Taking the figure relating to the number of cattle dipped in Natal, i.e. 51,458, and assuming that these animals were dipped on an average weekly it means that over one million animals are dipped in six months; the total number of accidents reported only amounts to one hundred and sixty-two cattle, eleven pigs, two sheep, one mule, two horses, one foal, and one donkey, and this mortality extends over a period of from one to ten years. On the other hand the accidents were with but few exceptions of such a nature as can be prevented. Many farmers attribute the deaths to carelessness, but so much experience has been accumulated now that serious accidents rarely occur.

EXTENT OF TICK INFESTATION.

The extent of the farms involved in answers to our queries cover an area of 732,250 acres (1144 square miles) or roughly one-eighteenth of the area of Natal, belonging to 287 owners; in addition to this some Crown lands, town lands, and native locations are mentioned. They are situated in all parts of Natal, represent various altitudes, telluric, and climatic conditions. These conditions naturally affect the tick infestation, and although three degrees of infection are present, i.e. slight, medium, and gross, yet they do not seem to stand in any direct relationship to the three grades of veld, i.e. high, middle, and low. Even at altitudes of 5000 to 7000 feet the tick infestation was stated to be gross, and on the coastal belt some farmers state that there are very few ticks present.

The relationship, if any, appears to refer more to the number of cattle on a farm, the larger the herd the greater the opportunity for

tick life. In some instances the absence of tick life is put down to the presence of the red-beaked tick bird. Farms in the midlands or the middle veld were stated to have been badly infested in most instances and moderately in others. In some parts of the low veld the ticks were so numerous that deaths of cattle were put down to this cause. Some farmers who have lost all their cattle previously from East Coast Fever, and who for restocking purposes after the erection of a tank introduced fresh cattle, stated that on those particular farms no ticks have been noted on the fresh cattle.

FENCING OF FARMS.

Natal seems to be the country *par excellence* of fenced farms. On the 287 farms referred to in our questions, it appears that only nine are not fenced; in the majority of cases the whole farm is fenced, and only in a few instances are portions of the farm or only paddocks fenced off. In far the greatest majority of cases fences had been finished before dipping had started; in a few cases fencing was started just before dipping was undertaken. Many of these fenced-in farms are sub-divided into paddocks. It stands to reason that the cleansing of the farm can be better and more efficiently carried out and maintained when by means of fencing strange and undipped cattle are kept out. The fences had in many cases been put up to keep out East Coast Fever and particularly for this purpose sub-division had been made, but with regard to the spread of Fever Coast Fever the presence of a fence in Natal did not seem to have formed an efficient barrier, one farmer even considering the erection of a fence to be useless. This can be understood when the extent of the tick infestation is taken into consideration.

THE COLLECTING OF TICKS.

Although the destruction of ticks on beasts is more or less systematically carried out in Natal, their collection by means of the grazing cattle does not seem to be attempted to any great extent, and it appears that such a procedure is not necessary. The answers are frequently to the effect that cattle graze where they like; others state that they graze all over the farm and in the winter more particularly in reaped fields. Some keep them in certain paddocks and change them in rotation, others again keep the cattle on the highest part of the farm during summer and on the lowest during winter. The motives for the changing about are not so much for the destruction of ticks as to regulate the grazing; only a few farmers state that they graze cattle to collect ticks, and only one man undertakes a systematic grazing of the whole farm for this purpose. In some instances cattle are kept in certain cleaned paddocks most convenient to the homestead so that the whole farm is not grazed over; the cleaning of the farm appears to be possible without any definite system of grazing other than that necessary to regulate the food supply, provided (as is evidently done in the majority of cases in Natal) the dipping is systematically carried out over a prolonged period. In order to clean paddocks some farmers keep cattle away for eighteen months and thus starve the ticks out.

DIPPING BEFORE THE INTRODUCTION OF "SHORT INTERVAL DIPS."

The history of dipping in Natal may be divided into two periods, viz., one of long interval dipping and one of short interval dipping. The former periods varied from occasional dipping (at very irregular

intervals in many instances) to regular intervals of four weeks, three weeks, a fortnight, and very rarely of one week. It is generally stated that the long interval dipping had no effect on the eradication of ticks or on the prevention of East Coast Fever. This only became evident after the "short interval dips" were introduced. From the replies to the question, "How long was dipping carried out previous to the appearance of East Coast Fever?" it can be seen that for periods from ten years down to a few days dipping was carried out notwithstanding which East Coast Fever appeared. Many replies were to the effect that spraying and hand-dressing was carried out over a long period. One man states he hand-dressed his cattle for forty-eight years previous to dipping. In some instances the intervals were shortened to seven days and had been carried out for seventeen months in one instance previous to the appearance of the disease. After the discovery of the "short interval dips" dipping was reduced to weekly or every third day, and in some cases to two dippings a week, and even alternate day dipping was adopted in a few instances; where the weekly interval was maintained one day a week was set apart for hand-dressing. The necessity of short interval dipping is proved by the experience quoted. If it is intended to prevent East Coast Fever and whilst there are ticks on the farm these intervals should not be longer than five days. This is clearly brought out in the replies to the question as to the intervals of dipping observed before and after the outbreak of the disease on the farm.

THE EFFECT OF SHORT INTERVAL DIPPING ON AN OUTBREAK OF EAST COAST FEVER.

The summary of the results brings out clearly that whatever the condition of affairs was at the time of an outbreak a most effective check was made on the disease within a very short time by the aid of short interval dipping. Where a dipping tank existed and where, on the outbreak of the first case of East Coast Fever, short interval dipping was started, this one case remained frequently the only one on that farm. In other instances a few deaths followed, but within the first few weeks they came to a standstill. In some instances, what may be called odd cases, occurred at intervals of a few weeks, a month, or a number of months. There are some records to the effect that from six months to twenty months isolated outbreaks occurred which in some instances were put down by the farmers to reinfection from a neighbouring farm. A recurrence of the disease has been traced to the stoppage of dipping at short intervals, either for the purpose of working the oxen harder or in winter time or to a weak solution of dipping fluid. A few outbreaks also occurred when the three days' dip was used as a long interval dip. For instance, one farmer states that after an outbreak of the disease he continued for some time with a three days' dip, but found now that with the weaker solution the cattle were dying faster, so he returned to the five days' dip. The short intervals are usually maintained until no recurrence of the disease manifests itself for a number of months or until the winter has approached, and sometimes even then at the risk of causing loss of condition or death of the cattle themselves.

It is evident from these few notes that by systematic short interval dipping the disease can actually be stamped out of a herd with but a small mortality if the dipping is thoroughly carried out immediately after the first outbreak and with a dip of proper strength.

Striking also are the results on farms where short interval dipping has been carried out in infected areas surrounded on all sides by farms which have been been infected for some years. Farms adjoining native locations where practically all beasts had died out never had any outbreaks, although cattle were dying on the very dividing fence. Some instances are quoted where the disease broke out amongst cattle belonging to natives on the same farm who refused to dip; they died out whereas the dipped cattle permanently escaped, although natives from the same kraals daily came up to the cattle sheds to milk the cows. It is pointed out that mortality is terrible amongst the native cattle generally, but that these natives who have dipped their cattle regularly with their master's cattle still possess them to-day. It is generally stated that the farmers who dipped most persistently and systematically still possess their cattle. The farmers who lost large numbers of their cattle through East Coast Fever have now erected dipping tanks and are restocking, taking the precautions of dipping their stock now as a regular practice. The confidence reposed in the safety of the stock by means of the dipping tanks has shown itself by the reintroduction of cattle on the farms on which the disease existed but was checked by the dip; thoroughbred bulls and heifers having been brought to such farms in many instances. Out of the 161 farms on which restocking has been carried out only three instances are given where cattle subsequently contracted the disease.

ADDITIONAL MEASURES TAKEN IN CASES OF OUTBREAKS OF EAST COAST FEVER.

These consist in hand-dressing cattle, burning of the grass in infected areas, moving cattle from infected areas, fencing in, temperaturing cattle, and isolating suspects and sick ones, and also grazing of sheep and goats together with the cattle. It stands to reason that in temperaturing cattle and isolating all suspects and sick ones a check is put on the infection of the farm, and the same naturally holds good in moving cattle completely away from the infected areas, and whereas the latter measure could always be recommended and was adopted by a number of farmers yet many, whom on account of the smallness of their farms or of the widespread infection and uncertainty of its whereabouts, had to rely solely on the dipping, were nevertheless able to stamp the disease out. Temperaturing which was said to be one of the most valuable adjuncts to dipping, was abandoned in some cases on account of the unreliability of the results after short interval dipping when there were frequently high records registered in perfectly healthy animals. There is, however, no doubt in our minds that systematic short interval dipping with a dip of approved and accurate strength can effectually check and finally eradicate East Coast Fever.

THE DIPPING OF SICK CATTLE.

This question was perhaps not clear enough; it was intended to mean only animals suffering from East Coast Fever, but the answers referred in the majority of cases to all animals that were sick. The general rule is to dip the sick animals as long as they are strong enough to walk up to the dip and go through the tank. In the majority of cases they are then isolated in a special paddock for sick animals or in a shed or any place inaccessible for other animals, and only in a few instances are these sick animals allowed to graze with the main herd. Some observe the rule of passing the sick animals through the tank

after the healthy ones have been through. In other instances sick cattle are not dipped but hand-dressed and sprayed, and some farmers do both to make certain. In rare cases neither dipping nor dressing is applied, the animals being simply isolated. In the case of East Coast Fever some farmers destroy the sick animals as soon as they are certain of the diagnosis, submitting blood smears for corroboration. Others who temperatured their cattle isolated them at once and hand-dressed and sprayed them; the dipping of sick cattle was carried out even at intervals of two days. Apparently it is realized by all that the animal suffering from East Coast Fever requires just as much, or perhaps even more, attention than the healthy ones, as it is a danger and a source of infection for ticks which by all means must be prevented.

In one instance a correspondent accuses dogs of carrying East Coast Fever and hence advises them to be dipped.

INTRODUCTION OF THE DIPPING TANK IN NATAL AND ITS GENERAL USE.

From the answers given it has been possible to show the increase in the number of tanks erected yearly in Natal. The figures being as follows:—

In 1902	0.9	per cent.	of the total	number of tanks	were erected.
In 1903	1.4	,,	,,	,,	
In 1904	3.6	,,	,,	,,	
In 1905	1.8	,,	,,	,,	
In 1906	2.7	,,	,,	,,	
In 1907	4.5	,,	,,	,,	
In 1908	4.1	,,	,,	,,	
In 1909	14.5	,,	,,	,,	
In 1910	29.2	,,	,,	,,	
In 1911	30.0	,,	,,	,,	
In 1912	7.3	,,	,,	,,	

Previous to dipping a good number of farmers had been hand-dressing their cattle in a systematic manner, but since then all these farmers, except two, have gone over to the dipping tank stating the dipping is a great advantage over spraying. This fact alone should be sufficient to show the advantage of dipping.

EFFECT OF DIPPING ON TICKS.

There are statements to the effect that a few days after starting the short interval dipping a decrease can be noticed in the number of ticks on the dipped animals; on the other hand a good many farmers say that the decrease only became evident after a number of dippings or only after a number of months. A reduction to a minimum only occurred after periods varying up to one or even two years. The decrease was stated to be most marked on the dewlap and udder, body, and between the hind legs, whereas the ticks persisted longer on the eyelids, in the ears, and under the tail. From the evidence it appears that the question was understood by some to mean a disappearance of the ticks from the beast indicating the immediate result of the dip, whereas, as the majority understood it, it meant the decrease of the number picked up by the cattle in the course of time. Information on both points is valuable. To the former conception refer the statements that the decrease was noticeable in a few days and to the latter idea a period of many months. There is a uniform opinion that the "blue

tick" is the first one to disappear. This statement must be interpreted in two ways. Farmers with but rare exceptions call practically all "engorged female ticks" "blue ticks," simply because they have a bluish tinge, whereas there is a species of tick (*R. decoloratus*) which is commonly known as the blue tick. Accordingly, we understand what was *a priori* expected by the disappearance of the blue tick, viz., that the female of any species are the first to suffer—all these females require some time to engorge—and in short interval dipping they have no chance of becoming replete if attached after one dipping and before the next one is due. Hence the apparent sudden disappearance of the female ticks. In the case of the true blue tick, however, the disappearance after a few months is actual; these ticks pass their cycle from larvae to adult on one and the same host and live in the larval stage on grass for about seven months, so that within that time, provided all were reached by dip, they must completely disappear. The next to disappear is said to be the "bont or tortoise-shell tick" which is, however, not present in all parts of Natal but usually on the low veld and in the coastal belt and on some farms in the middle veld. Some farmers state, however, that it is one of the hardest to kill and only disappears very long after dipping started, and on some farms it was even the one to persist longest. This statement can be understood if we remember that this species of ticks (*Amblyomma hebraeum*) requires long periods between its moulting process so that stragglers may be caught only at a very late period long after dipping started. The disappearance of the brown ticks (East Coast Fever ticks) is stated to take some time, and although they are but rarely met with on the body they seem to persist on various regions of the head. It is on account of the life history of these disease-carrying ticks that the long interval dipping was of but limited use, and this is also the reason of their long persistency in a grossly tick infested area. In the summer these ticks can live in the grass for over a year, so that even in five days interval dipping a certain number of larvae and nymphae always escape, only to be caught in their adult stage when they remain on the beast for a longer time and will be reached at a subsequent dipping. But the last tick to disappear—all the farmers agree on this point—is the red tick or the flat brown tick with the red legs, as some call it, and which attaches itself in a well protected region under the tail. This is, however, not the only reason for its longevity. The nymphal stage of the same tick lives deep in the meatus of the ear where very likely no liquid enters and where in the majority of cases even the hand-dressing will not be sufficient; this tick by predeliction attaches itself to horses, sheep, and goats which are principally responsible for its maintenance. If beasts would be the only hosts its destruction would be more easily effected. The brush and sheath are also indicated as places where the ticks are found.

With regard to the stamping out of ticks on a farm, the evidence shows that even after years of dipping ticks will be found, but speaking from a practical point of view they are so rare that they have to be searched for.

One statement is that there are now hardly 1 per cent. of ticks as compared with five years ago. There is also a statement that the ticks only disappear after two years constant dipping and that the tortoise-shell and brown ticks were still present after three years. Several farmers say that after two years dipping there are still some to be found, and it is again the red tick which is mostly present.

There are also statements to the effect that the striped legged tick (*Hyalomma aegyptium*) persist for a long while, and this can be understood since the intermediate stages live on birds. A farmer states that after his farm had been cleaned by dipping storks brought ticks on to the farm which he describes as the kind of tick so prevalent in the western Free State. Fortunately this tick does not do any harm in connection with East Coast Fever. Judging by the life history of the tick this observation of the farmer is probably correct. The discrepancies noted in the length of time ticks live on a farm seem to stand in some relation to the state of tick infestation at the date of dipping to the number of cattle present, whether small stock is dipped, and whether there are numbers of game and wild animals present, all of which help to maintain and prolong tick infestation. Since, however, it has been shown that short interval dipping of cattle is a preventive against East Coast Fever it does not appear to us that other stock need be dipped as frequently, and only when a complete eradication of all ticks is contemplated at will this action be necessary.

TICKS ON GAME AFTER DIPPING.

The ticks which live on domesticated stock are also found on game and certain classes of other wild animals; this is particularly the case with the brown tick and for which hares seem to be a favourite host and also antelopes. On game are sometimes found the larvae and nymphae of the bont legged tick. The systematic dipping of cattle on a farm must accordingly have its effect on these animals in the course of time but on the other hand the presence of birds and game tends to maintain the ticks. Although the attention of the majority of farmers was not given in this direction a good many answers show that they were not overlooked.

With regard to duikers, one statement is to the effect that in former days duikers were smothered with ticks whereas none can now be found on them. Another statement about wild cats is to the same effect. Oribis, which in Natal seem to be fairly numerous, now carry fewer ticks than they used to do in pre-dipping days. Another farmer says that at one time all buck and hares shot on the farm were infested with ticks, especially hares, but this season no ticks were found on the buck and hares killed. Similar statements are made concerning the rietbuck, vaal rhebuck, and the haartebeeste. There are, however, a few remarks stating that the ticks on these animals were as bad as ever. This discrepancy might find an explanation if the conditions of the various localities were known in each particular instance. Nearly all statements concerning ticks on the bushbuck indicate that the dipping of cattle has in no way affected these animals, and it is pointed out that the cattle do not go into the bush where these buck live and accordingly the ticks are not destroyed. Similar reasons may account for the farms where duikers, reedbuck, and hares were still infested. It is also stated that the bluebuck is found infested with ticks notwithstanding dipping.

DIPPING AS A PREVENTIVE OF OTHER DISEASES.

It had to be expected that with the disappearance of the ticks other tick-borne diseases would be checked, as well as the various skin diseases so frequently observed on practically all classes of stock, the beneficial influence on calves is stated in many instances to have been simply marvellous; where before dipping losses of 50 per cent. of all

projeny was the rule, the losses are now reduced to a trifle. The cause of death was, in many instances, put down to hair balls, a statement which speaks for a general unthriftiness caused by skin diseases, lousiness, etc., inducing the animals to lick themselves, and it is admitted by far the greatest number of farmers that all these disabilities have disappeared. What comes almost as a surprise and was unexpected is the practical complete disappearance of white scour in calves, an observation which will help to clear up the hitherto doubtful etiology of this disease. The statements are practically unanimous and undoubtedly convincing. One farmer says that just before dipping he lost about one-third of his calves from white scour, since dipping he has only lost six calves out of a number of 180. Previous to dipping it was said to be almost impossible to rear calves when their mothers were milked twice daily. Navel ill is also reported to have disappeared. This improvement of affairs came about gradually, one man says, and was quite marked within three or four months. Another man says since the short interval dipping was introduced practically all diseases disappeared. At one time, nine or ten years ago, the calves died to the extent of 70 per cent. After the first few dippings the death-rate was reduced to 10 per cent. and fell about two years ago to 2 per cent. There are also some statements that the specific pneumonia of calves disappeared after the introduction of the dipping, and one statement goes to say that worms in calves also disappeared. The influence of dipping on skin diseases in all stock is very frequently alluded to. Ringworms and warts disappear in the course of time, the lice are naturally also killed; the so-called mange or "brandziekte," which is frequently found in cattle and horses in winter time, vanishes in dipped animals. Redwater is particularly emphasized to have become a thing of the past and instances are quoted where cattle were safely introduced on to the farms where previously 50 and more per cent. died. A farmer stated that Cape cows used to die in a fortnight after arrival. He bought forty of them between January and October; they were running with his own cattle and he has only lost two. Another instance given is equally as illustrative. A farmer says he restocked his farm with cattle from the upper districts. The dip was flooded out last October, and owing to some damage on the railway he could not procure arsenite of soda and for three weeks his cattle were not dipped. An outbreak of redwater occurred and of thirty animals which sickened he lost about one dozen; as soon as he recommenced dipping redwater disappeared. The importation of many thoroughbred bulls, of which none are reported to have contracted redwater, shows that on these farms the disease must have disappeared. With regard to gall-sickness the statements are not so uniform. There is evidence to show that gall-sickness disappeared entirely from a great many farms, on others it is reduced, whilst there are statements showing that notwithstanding dipping gall-sickness is still found.

This discrepancy can be explained in as much as there are a number of diseases going under this name, one, now known as anaplasmosis, is tick transmitted, but some are caused by vegetable poisoning and these naturally would not be affected by the dipping. The disease heartwater in cattle, of which, however, very little mention is made in the inquiry sheets, is also known as gall-sickness, and may perhaps be referred to under this name. Some controversy exists about the disappearance of opthalmia in cattle, particularly in

calves. A good many statements, probably the majority, are to the effect that this illness completely disappeared, whilst others state that it is in no way influenced by dipping. We are not able to account for this discrepancy, but since the statement as to the non-efficiency comes mostly from the high veld where dipping is discontinued in the winter, this fact might account for it. There exists also the possibility that there is more than one kind of eye disease. The one we know of is caused by a small worm under the eyelids, which for its transmission perhaps requires a carrier. It is quite possible that this carrier is a fly and it is quite within the bounds of possibility that the fly is destroyed by continuous dipping.

One remarkable statement is made by a farmer that since the introduction of cattle dipping his losses from all kinds of diseases were less than before and this notwithstanding the fact that East Coast fever had gone through his herd.

Some farmers also dip their horses during the horse-sickness season, and one who dipped at short intervals thinks he has had no losses, whilst one who dipped at weekly intervals lost six out of nine.

The dipping of sheep during the blue-tongue season is also specially referred to as beneficial; the disappearance of scab in some flocks is also admitted. One farmer, however, stated that notwithstanding four dippings of laboratory strength of arsenite of soda he was not able to cure scab in sheep. Vermin are also said to disappear as a result of dipping. A farmer who dips his dogs regularly states that he now never loses any dogs from biliary fever and is able to rear all his puppies.

The fly nuisance in the homestead and in the kraals is said to abate as a result of dipping the cattle.

GENERAL REMARKS.

In the last question contained in the pamphlet correspondents were asked to add any remarks they considered appropriate to the question of dipping, and we feel that we cannot do better than quote some of these opinions *in extenso*.

From Alfred County.—" Never stop dipping, now the heifers have all their teats, the oxen the whole of their ears, and there is no catching of cattle to get at sores and maggots, etc. The cattle are sweet and clean."

From Pietermaritzburg.—" My belief is that the only practical way of enforcing dipping, where necessary, is to make it penal to take cattle on to a highway or public place unless perfectly free from ticks."

A resident of *Estcourt* says: " I would add that even if there was no such thing as East Coast Fever it would pay handsomely to put up a dip and dip your cattle."

From Pietermaritzburg.—" During the time my cattle in a four-acre paddock were sick and dying I put in four old beasts and one young calf and kept them there for five months, not bringing them out to dip once, and although the twenty head temperatured out of herd all died and were buried in paddock; the five head put in for the sake of the feed never got sick. After the five months I temperatured them and finding them normal brought them out and dipped them and they are alive and well to-day, which I think goes to prove that cattle dipped at short intervals shed no infection, even if allowed to run with herd."

From Pietermaritzburg District.—"We think every farm should have a dip; we consider it the very best thing we ever spent money on and has made farms in tick infested parts worth more than double their former value, and the cattle are a pleasure to look at, whereas before it made one feel disgusted with the country to see the cattle so eaten up with ticks."

Another Pietermaritzburg farmer remarks: "From my experience I would prefer having tick fever amongst my cattle than lung-sickness or rinderpest, because by careful dipping a farmer can stop the tick fever."

From Ixopo.—"The difference in the appearance of my cattle now and what they were seven years ago is incredible; formerly they were incessantly rubbing and scratching and invariably thin, now all is contentment with glossy coats and a pleasure to the eye generally."

Compulsory Dipping.—The great majority of the Natal farmers are strong advocates of compulsory dipping, and many are in favour of the appointment of inspectors whose duties would be to see that cattle were regularly dipped in liquids of approved strengths. It is also suggested that the Government should erect tanks in suitable centres throughout the Union. Compulsory dipping is particularly recommended for cattle belonging to natives and many of the spasmodic outbreaks of East Coast Fever are said to be due to infection from native kraals, either by means of cattle or through ticks being accidentally carried on clothing by the natives on their visits to adjoining kraals situated on clean farms. In a few instances correspondents aver that natives now recognize the value of dipping and would be quite prepared to dip their stock provided a European was there to supervise the operation each time. Another farmer suggests, as an alternative to the erection of tanks by the Government, that a farmer who is too poor to erect his own tanks should be allowed to dip his cattle at his neighbour's tank, and he is of opinion that the neighbours would be only too glad to grant the necessary permission for the sake of all concerned in the transaction.

The Sombre Twig-pruner.

THERCLADODES KRAUSSI, WHITE (SYN. *CLONIOCERUS KRAUSSI*).

By CLAUDE FULLER, Government Entomologist, Natal.

THE selection of a popular term for application to an insect pest is not always an easy matter if a choice has to be made of a word, or combination of words, both suitable and descriptive. This is, or should be, a golden rule among entomologists who write for the information of the general public, more particularly because so many of the

vernacular names now employed are not at all descriptive and, as frequently, quite misleading.

Known to me for a number of years by its attack upon privet hedges, as a common name "privet pruner" always seemed apt enough for the creature forming the subject of these notes; but, in view of the fact that it has also been found destroying ash, olives, and jasminum, such a pseudonym is obviously not sufficiently expressive. Its natural food plants are the wild olives, of which there are a number of native species,* and so far as is now known the insect feeds only upon oleaceae. Because of this predilection it might well have been called the *oleaceous pruner* were it not that it is not given to most of us to know that privet, ash, olive, and many another plant belong to the one botanical order.

The appellation now submitted, *sombre twig-pruner*, applies in the first part to the strikingly funereal aspect and ornamentations of the adult beetles, whilst "twig-pruner" describes the remarkable and peculiar habits of the larval form or "borer" stage.

The species is aboriginal and was catalogued in 1855 by White from Port Natal. Distant, in *Insecta Transvaalensia*, gives the following localities: Angola, Waterberg, and Zoutpansberg (Transvaal), and Amajuba (Natal). In 1900 specimens were sent to C. P. Lounsbury from Fort Cunnyngham, western Cape Colony, where they had effected considerable injury to the young ash in the forestry plantations. C. K. Brain, of the Entomological Division, collected adults at Tegweni, near Plumtree Siding, in Southern Rhodesia, finding the beetles quite common there upon thorns during December and January, 1907-8. More recently I have received examples of the pruner's characteristic work in the form of pruned olive branches from Tokai, near Capetown. It is therefore widely spread throughout South Africa, and may be expected sooner or later as a pest wherever any of its food plants are grown extensively.

Such observations as I have been able to make upon this insect's habits and development are in connection with its attack upon privet, with the exception of casual notes where jassamine, olives, and the native species *Oleae verrucosa* were involved; and it was the extraordinary degree that its destructiveness to privet hedges during 1910 assumed which led to an inquiry extending more or less continuously over twelve months. Despite the fact that every available opportunity has since been taken to collect as much information as possible, there are many points still unexplained because of the hidden life of the larva.

For some ten years previously the insect's work upon an occasional hedge had been noticed, but this was never sufficiently pronounced for me to regard it as of economic importance. Despite the fact that to-day scarcely a privet hedge exists in Pietermaritzburg which is not invaded to some degree—many of the older hedges have been dug out solely on account of the pruner—I hesitate to give it the status of an important insect enemy; but were olive culture to assume any importance anywhere in the Union it would be indeed a serious pest.

An outstanding feature of the attack on privet is that it usually starts in a small way, becoming more intensified from year to year,

* *O. verrucosa* (the umqua) and *O. woodii*.

because the broods of beetles display but little tendency to migrate and a decided inclination to lay their eggs in the plants wherein they themselves were nurtured.

One thing can be said at once regarding this insect, and that is that it is most easily controlled. Its work and the accompaniments are conspicuous always, whilst the borers are so readily traced that any plant or plants can be freed of them at once by removing the invaded stems.

Supplied with a good knife, a sharp eye, and a pair of seccateurs, one has but to have a casual knowledge of this "nature pruner's" proclivities, its life-cycle, and its habits to accomplish a thorough and effective treatment.

FIG. 1. A good eye, a sharp knife, and a pair of seccateurs are the main requirements for the control of the sombre twig-pruner.

THE LIFE-CYCLE.

The majority of adults emerge from the tunnels in November—some perchance a little earlier and a number later. Soon after emerging mating occurs and egg-laying commences. As beetles keep on emerging until the end of January so the egg-laying is spread over no less than four months of the year. Therefore one has to be careful to distinguish between the main brood and the progeny of both early and belated individuals, because the later the eggs are laid just so late does the resultant insect put in its appearance the following year.* Ordinarily, the eggs hatch in twelve days and the borer starts tunnelling in the centre of the stem, from time to time pruning off portions of the already perforated part. This boring is continued towards the root along the downward axis of the plant, and no upward

* There is every reason to believe that the insects first coming to the adult stage wait in the tunnels until the greater part of the brood is mature. Adult records: Lounsbury, December, 1900; Brain, December and January, 1907-08; Pietermaritzburg, 2nd December, 1906, adults abundant and egg-laying 14th to 16th November, 1910: late individuals found laying, 3rd February, 1911; and on 20th February, 1912, they were unusually numerous. Adults found in stems: 15th October, 1906; emerged 2nd December, 1906. Adults found in stems: 3rd September, 1910, 3rd and 16th October, 1910; emerged 15th November, 1910. Larvae, pupae, and adults found in stems: 15th September, 1906, also 3rd September, 1910, and 2nd September, 1911; larvae and pupae found in stems, 2nd September, 1912.

nor lateral deviation is ever made apart from the initial burrow mentioned later. The grub stage of the main brood is completed during August and September when the transformation to the pupa state takes place. These pupae change into beetles during September and October, to emerge in November, laying the bulk of their eggs during the latter half of that month and December.

Because there are some eggs laid by early adventurers before November and many belated ones in January and February, an examination of an infested privet hedge will disclose a state of affairs which is better illustrated by a diagram than told of in many words.

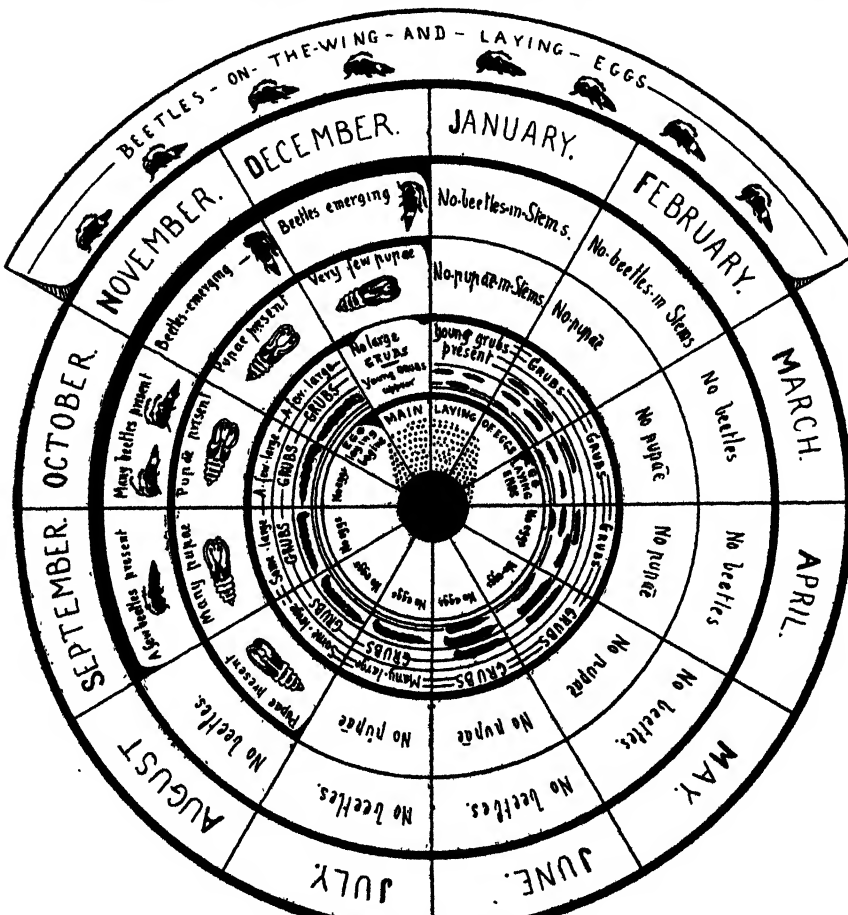


Fig. 2. A Calendar for the Sombre Twig-pruner.

With the aid of the above calendar one can "see at a glance" what is the exact position of affairs in the development or life-cycle of the pest. Taking the month of November as presenting the most complex reading, we see that some beetles are on the wing and laying eggs whilst others have not as yet bored their way out. Then it will be noticed that some of the insects are still in the pupa stage, whilst a few grubs have not as yet finished feeding. In the newly deposited eggs we have the beginning of the cycle.

The Sombre Twig-pruner.

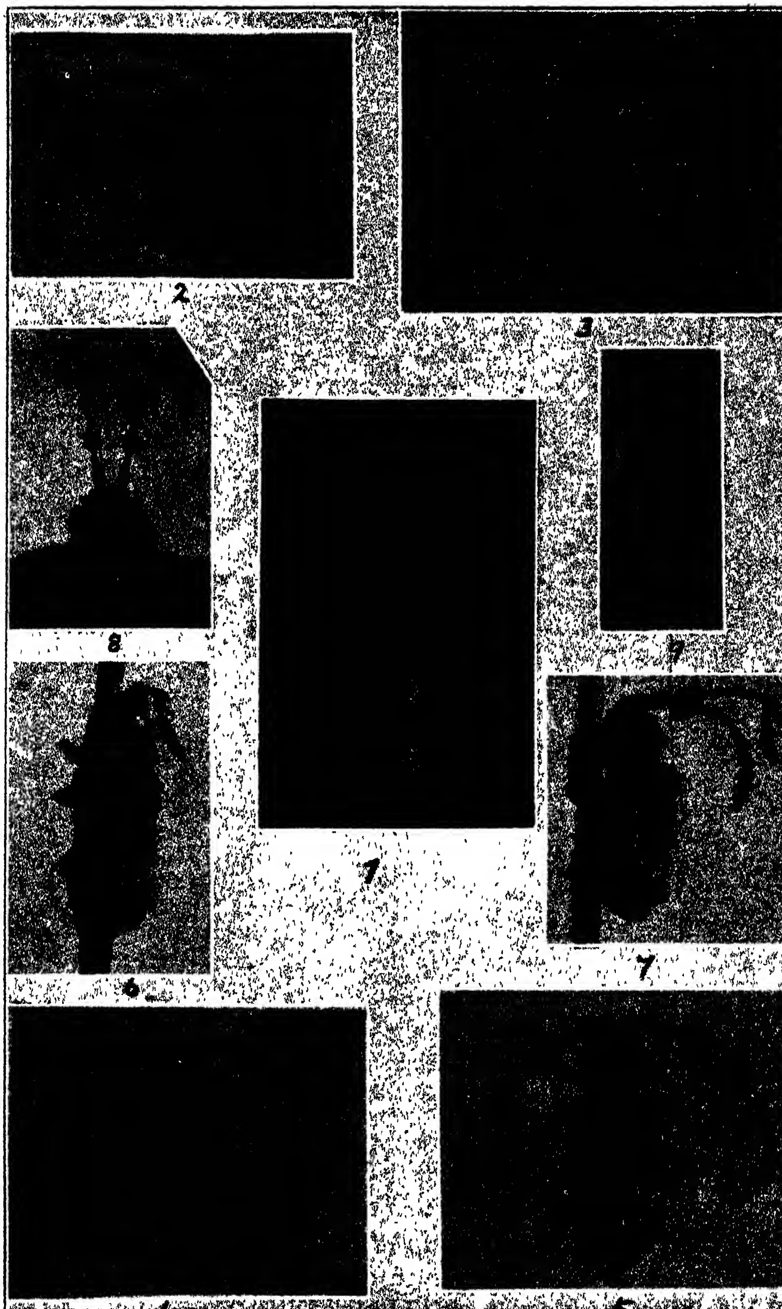


Plate No. XIV. *Photo by Albert Kelly.*

THE ADULT BEETLES.

1. Above, the male; below, the female (natural size). 2. male (enlarged). 3. Female (enlarged). 4. Male (enlarged). 5. Female (enlarged). 6, 7, 8. Females (enlarged) in various attitudes. 9. Side view of head and antennae (enlarged).

The period when beetles are on the wing and laying eggs is seen to extend from the beginning of November to the end of February; after this the beetles die off. It will also be seen that beetles are to be found in the stems preparing to emerge from September to December, and that the pupae put in their first appearance in August and some can be found through until December. The most striking feature is that grubs are to all intents and purposes present all the year round, and that before all the large grubs from the previous season's egg-layings have finished feeding young ones are already voyaging from the young growth down towards the larger stems.

The practical application of such a chart as this is that it can be utilized in the actual work of exterminating the insects from, say, a hedge of privet, showing exactly in what form the pest is to be looked for.

THE ADULT INSECT.

The parent of the twig-pruner (Plate XIV) is one of our most striking longicorn beetles; not that it is graceful, as the majority of these beetles are, nor brilliantly coloured, as might so easily be the case, but rather on account of the abnormal formation of the antennae and the unusual ornamentations of the wing-cases. In point of fact, it is rather a funereal creature, with short, sturdy legs and black-plumed tip-curled antennae, held, as a rule, at right angles to the body; all very reminiscent of the old-time plumes of a hearse. There is no particular difference between the sexes, except that the female is larger than the male, as is so frequently the case among insects. The head and body are of a dense black colour, except for broad patches of buff on each side of the thorax and a wide band of the same hue, speckled with red, which extends across the hinder region of the wing-cases. The thorax is gross and bears four conical projections. The legs are black, but mottled in appearance owing to the presence of small patches of buff-coloured and reddish hairs. The antennae are the remarkable features. Instead of being cylindrical, slender, and tapering, as is the general rule with longicorns, they are made up of joints of varied lengths and shapes. The first is fairly large, stout, and hairy; the second short and hairy; the third long and slender but swollen at the apex, where is borne a plume-like bunch of hairs; the third and fourth segments are fairly long and slender, whilst the series that follow are short, broadly flattened, and very angular. Except for the slender part of the third joint and the fourth, fifth, and sixth joints, all of which are buff-coloured, the antennae are black. The under-surface of the body is clothed with many red hairs. Other remarkable features of the insect are its general hairiness, together with the tufted humps upon the anterior region of the wing-cases and the numerous tufts projecting from the posterior region of the same organs.

REPRODUCTION.

The Laying of the Eggs.

Reproduction begins very soon after the beetles make their exit from the privet stems, and eggs are deposited within the young and slender growths or "water shoots." The act of ovipositing has frequently been observed, and despite the intelligent discrimination evidenced prior thereto, it is curious how often the action of the beetle varied immediately afterwards. Some females were seen to

The Sombre Twig-pruner.

Plate No. XV. *Photo by Albert Kelly.*

THE LAYING OF THE EGG.

1. Female beetle about to excavate an egg-cavity (enlarged). (Note.—The photograph was taken just after the insect had alighted on the twig, and a portion of the flying wings has not yet been withdrawn beneath the wing-cases. The figure should be viewed with the stem perpendicular for a correct representation.) 2. The site (×) of a recently laid egg (enlarged). 3. The site (×) of a newly laid egg (magnified twice). It is to be noted that the adult beetle has pruned off the twig above the egg and unusually close to it. Beneath the bud is seen an abrasion where the leaf-stalk was eaten away. 4. A split twig (slightly enlarged), showing the egg (×) resting in its cavity. The apex of this twig was completely pruned off by the parent beetle.

first travel up to the apex of the selected shoot, and, apparently finding everything satisfactory, descended about six inches and selected a spot upon the internode for the placing of the egg. It is assumed, on very reasonable grounds, that the reason for this preliminary examination was solely for the purpose of noting whether or not some other beetle had secured a prior claim by already placing her egg therein; in view of the future development of the young, were the egg laid in a part already "bespoken," such would lead to unhappy results. Although it happens at times that two eggs are laid in one and the same twig, or in two arising from the same stem, and a life lost in consequence, only about eight such instances were found in over one hundred examinations, and in quite half of these one of the two eggs failed to hatch.

The diameter of the twig at the point chosen is almost invariably one-tenth of an inch, and usually just where the twig has lost some of its greenness (see Plate XVI, fig. 1). The distance from the apex of the twig has been measured in thirty-two instances, out of which sixteen were between 5 and 6½ inches from the tip, seven between 7 and 8½ inches, and eight between 10 and 12½ inches, whilst one was at 4½ inches. The egg is placed in a cavity underneath the bark, which is excavated with untiring patience and extreme nicety to the exact size and shape of the egg it is to receive (see Plate XV, fig. 4). The making of this egg-cell occupies from forty to sixty minutes. Operations are begun by the cutting of a longitudinal slit in the bark with the point of the mandible. Into this the right mandible is inserted, and rapidly and carefully the woody tissue is scraped away in many minute particles, the slit only opening out as the mandible sinks deeper in. Whilst working with the right mandible the point of the left is pressed into the bark and acts as a fulcrum, being moved from point to point so as to oppose the working jaw. After working for a little while with one jaw the cutting is carried on by the other for a like space, the freed jaw in its turn acting as the fulcrum. In this manner, one jaw frequently relieving the other, a cavity is made which is quite cylindrical and rounded at either end.

Whilst at work, with her face closely applied to the twig, the beetle offers a striking likeness to some savage animal chewing a bone (Plate XIV, figs. 6 and 7; Plate XV, fig. 1).

So far as the egg-cell is concerned, the external evidence of the lengthy operation that has taken place would amount to very little were it not that the frequent shifting of the sharp point of the unemployed jaw pricks and roughens the tender bark, so that either side of the slit is subtended by symmetrical, reniform, brown patches. On this account the spot is very distinct for some time (see Plate XV, figs. 2 and 3).* Later, as this injury is repaired by the growth of the bark, it becomes less distinct, but the spot is rendered none the less conspicuous owing to a slight swelling of the twig, the irritation set up by the beetle's operation causing a certain amount of cell hypertrophy (see Plate XVI, fig. 1 at ×).

Having made the cell, our beetles were noticed to move forward and insert the egg; this was done somewhat slowly, the ovipositor being closely applied to the opening. The egg laid, the orifice is

* In a few cases the egg-cavity was so well made that it was difficult to pick it out an hour or so afterwards.

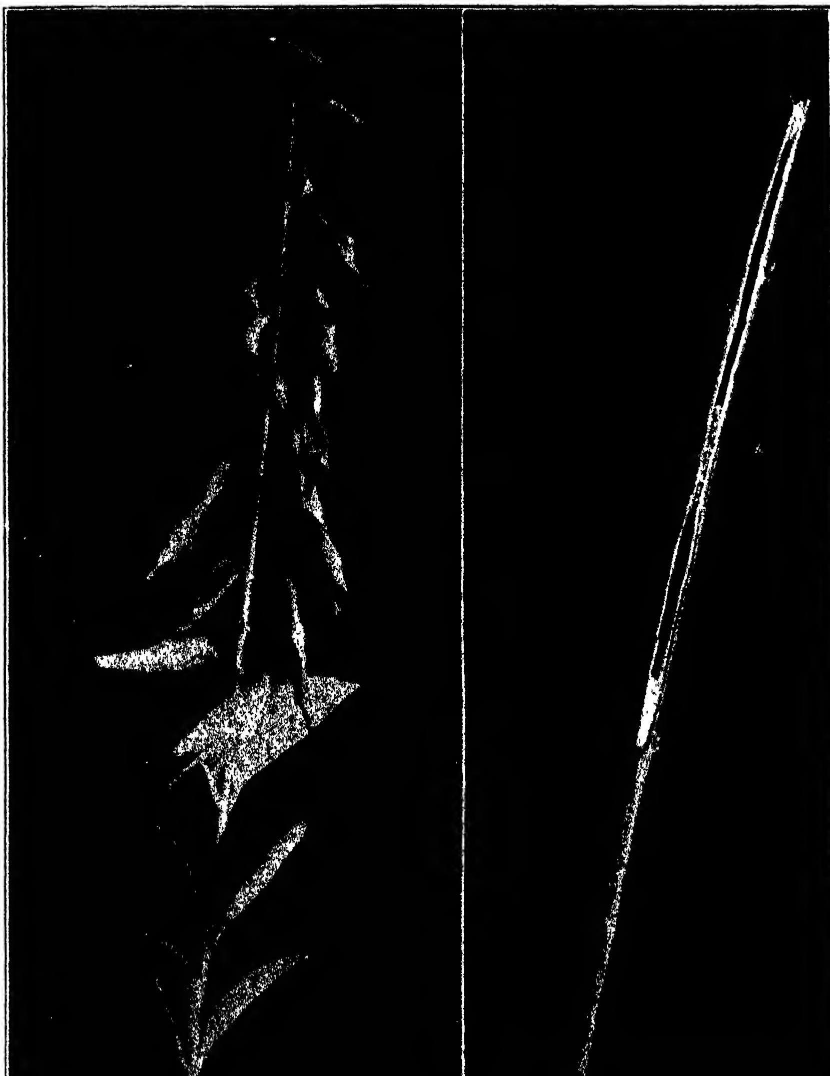


Plate No. XVI. *Photo by Albert Kelly.*

THE WORKINGS OF THE YOUNG BORER.

1. A privet shoot, about half natural size. The egg-site is indicated at ×, and it is to be noted that in consequence of the burrowing of the young grub the foliage of the part above the egg is already withered and dead. In this instance the parent beetle interfered in no wise with the twig, neither before nor after laying her egg. 2 A young privet shoot showing a young borer (×) after making its first pruning.

cleaned of débris by a rubbing action of the abdomen, and a gummy substance is exuded from the anal segment for the purpose of caulking the slit. As this substance exudes, the insect frequently "taps" it down with the tip of her abdomen. Curiously enough, most of those under immediate observation, after giving the finishing touches to the work, proceeded up the twig a couple of inches and there girdled it, so that it fell over and broke off, as in Plate XV, fig. 3. This was at first taken to be a regular practice, but it appeared later, from more extensive observations, that in the majority of cases the tip was not interfered with, as in fig. 1, Plate XVI. Of forty-two records, in twenty-seven cases the tips had been left intact, whilst in the remaining fifteen they had been bitten off from a quarter of an inch to even six inches above the egg. The following were the measurements taken: $\frac{1}{4}$ in., $\frac{1}{2}$ in., $\frac{1}{2}$ in., $\frac{1}{2}$ in., $\frac{3}{4}$ in., 1 in., $1\frac{1}{10}$ in., $1\frac{1}{4}$ in., $1\frac{1}{4}$ in., $1\frac{1}{2}$ in., $2\frac{1}{2}$ in., 3 in., 5 in., 5 in., and 6 in.

Every observation goes to show that there was neither rhyme nor reason nor necessity for this pruning, whilst an amputation made anywhere lower than one and a quarter inches above the egg produced unnatural surroundings for the young. Perhaps such pruning is quite necessary in the case of the native host-plant, but the favourable conditions offered to egg development in the privet are tending towards the disappearance of a natural instinct, these observations being upon at least the fourth generation of privet-nurtured insects.

One beetle under observation behaved in a very peculiar way. After examining a shoot she started five inches down from the tip and proceeded to defoliate it, biting off each leaf—ten in all—from that point to the tip. Each leaf was bitten through with slow patience at the base, the petiole being eaten and the blade allowed to fall to the ground. Little patches were also chewed out of the bark. In this manner she engaged herself for three hours. She then went to the next shoot, laid an egg, and then bit the tip off an inch and a quarter above the egg without removing any leaves. From that she went to another and laid an egg, leaving the shoot intact. Although the majority of eggs are laid without any interference with the selected stem, the following instances show that a vague instinct exists to secure a plentiful flow of crude sap to the egg. One chewed off six leaves, four above and two below the site of the egg, but did not remove the tip, whilst another, which laid its egg 7 inches from the tip, bruized the shoot in three places above the egg and removed seven of the leaves. One laid its egg 10 inches from the tip and left both foliage and stem intact. A fourth removed the tip 5 inches above the egg and bared the remainder, cutting off seven leaves in all. To all these instances parallel cases were noted, and in all the eggs subsequently hatched.*

It is well known of one group of longicorns (the "girdlers," *Oncideres*), that after laying an egg in a small branch the parent beetle proceeds to girdle the branch around with a deep incision *below* the egg, so that, sooner or later, the portion containing the larva breaks off and falls to the ground. This being so, the natural inference is, first, that any flow of sap or subsequent rapid growth would be inimicable to the egg; and, second, more or less dry and gradually

* I think it may be accepted that the beetles feed upon the leaf-petioles, but with one or two exceptions eggs were always found in twigs from which leaves had been removed, indicating the attainment of a further object.

The Sombre Twig-pruner.

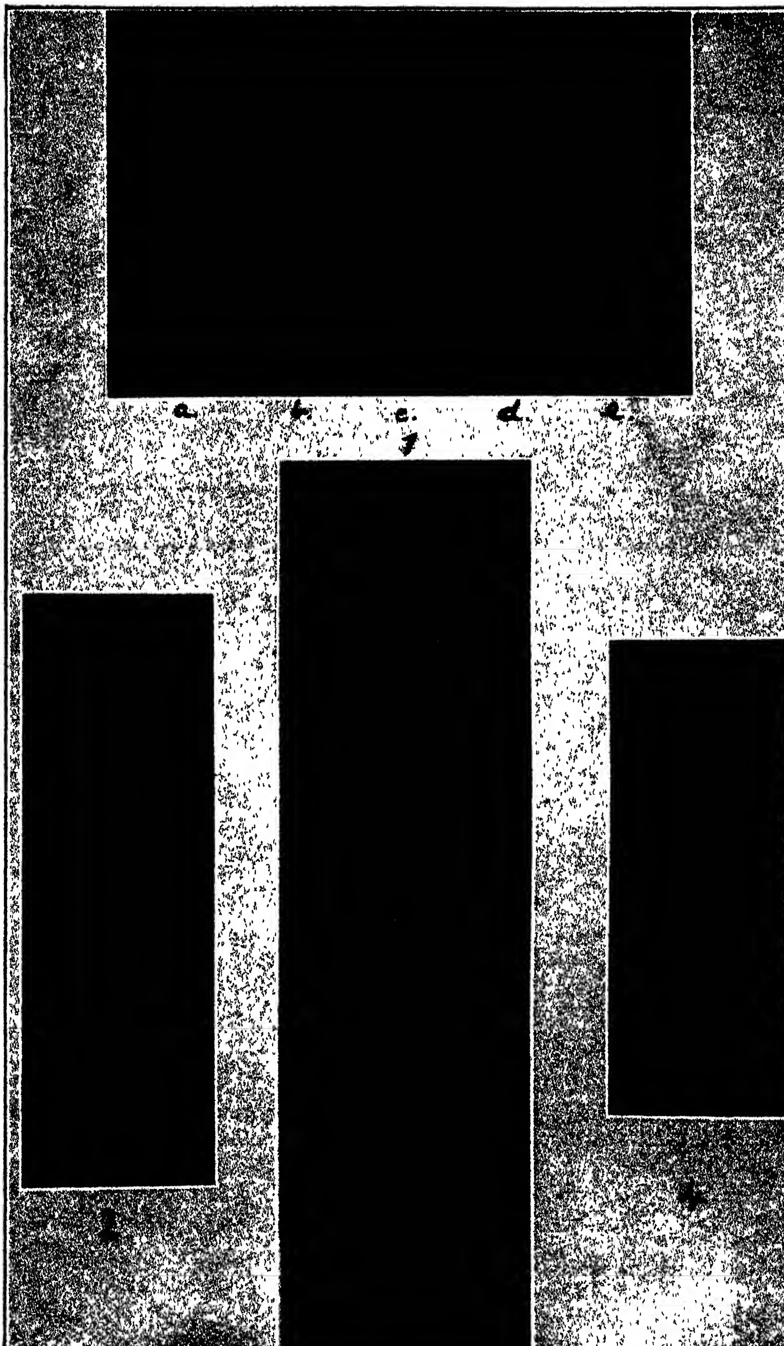


Plate No. XVII. *Photo by Albert Kelly.*

THE BORER AND CHRYSALIS STAGES.

1. *a*, a half-grown borer; *b*, a full-grown borer; *c*, *d*, and *e*, chrysalis or pupae; *c*, side view; *d*, back view; *e*, ventral view (all natural size). 2. A half-grown borer (much enlarged). 3. A full-grown borer (much enlarged). 4. A chrysalis or pupa viewed from below (much enlarged). (Note the various organs of the adult beetle showing in relief.)

decaying wood is the most suitable food for the larva. In the case of the insect now under discussion, the girdling when done must have for its object an exactly opposite state of affairs, that is, the egg, through its period of incubation, requires moist surroundings and a plentiful supply of crude sap is essential to the young. That such is, indeed, the case is exemplified in every phase of this insect's development.

The egg, of whose nativity so much has been said, is by no means a minute object, being one-twelfth of an inch in length and half that in diameter. It is translucent and a greenish yellow, smooth and shining; in shape cylindrical with rounded ends (see Plate XV, fig. 4). The period of its incubation has been satisfactorily determined as twelve days, and the hatching of the young borer watched by placing the egg in a glass cell provided with a moist atmosphere.

NATURAL CHECKS.

Parasitism of the Egg.

Considering the remarkable amount of ingenuity, the neatness of the work, and the labour and time expended over the laying of the egg—an hour or so must be a lot out of a lifetime of six or eight weeks, for surely the hard-working grub in the darkness of the stem cannot be said to "live"—there is really something quite pathetic in the fact that the destruction of the egg is often assured, perchance as soon as it is laid, for many are parasitized. The agent of their destruction is a microscopic wasp; and, small as the eggs are to our eyes, they contain sufficient nutriment to bring at least five wasp maggots to maturity. But few observations have been possible in connection with this parasite and its habits. Those under notice reached maturity about four weeks after the eggs were laid, so it is possible that there are two or three broods during the egg-laying season of the beetle. What becomes of these minute creatures between one season and the next, and how they exist for eight to nine months out of twelve, are matters upon which one hardly cares to speculate at present.

So far no parasites nor enemies of the grubs or pupae have been noticed, and this is all the more remarkable because the larvae are very exposed to such attack. Not only does it live surrounded by a thin wall of soft texture which many forms of parasitic wasps could perforate with their ovipositors, but the vent holes to which reference is made later on are so large that they would admit the entrance of quite formidable parasites.

Against this only is to be set the activities of the larva and its extreme susceptibility to the slightest irritation. Still it must be borne in mind that it has not been practicable to study the insect in its "wild state," so to speak, which may reveal quite a different state of affairs.

THE BORER'S EARLY DEPREDATIONS AND ECCENTRICITIES.

From the egg there develops a footless grub or borer, a jointed creature with the anterior or thoracic segment so much developed that it looks like an abnormal and bald head, which appearance it owes to the presence of a hard plate, like a piece of roundish, polished marble. Below this swollen segment is to be seen the real head, smallish in size, of reddish colour, and furnished with powerful biting jaws. From out of the upper part of the last segment there projects a

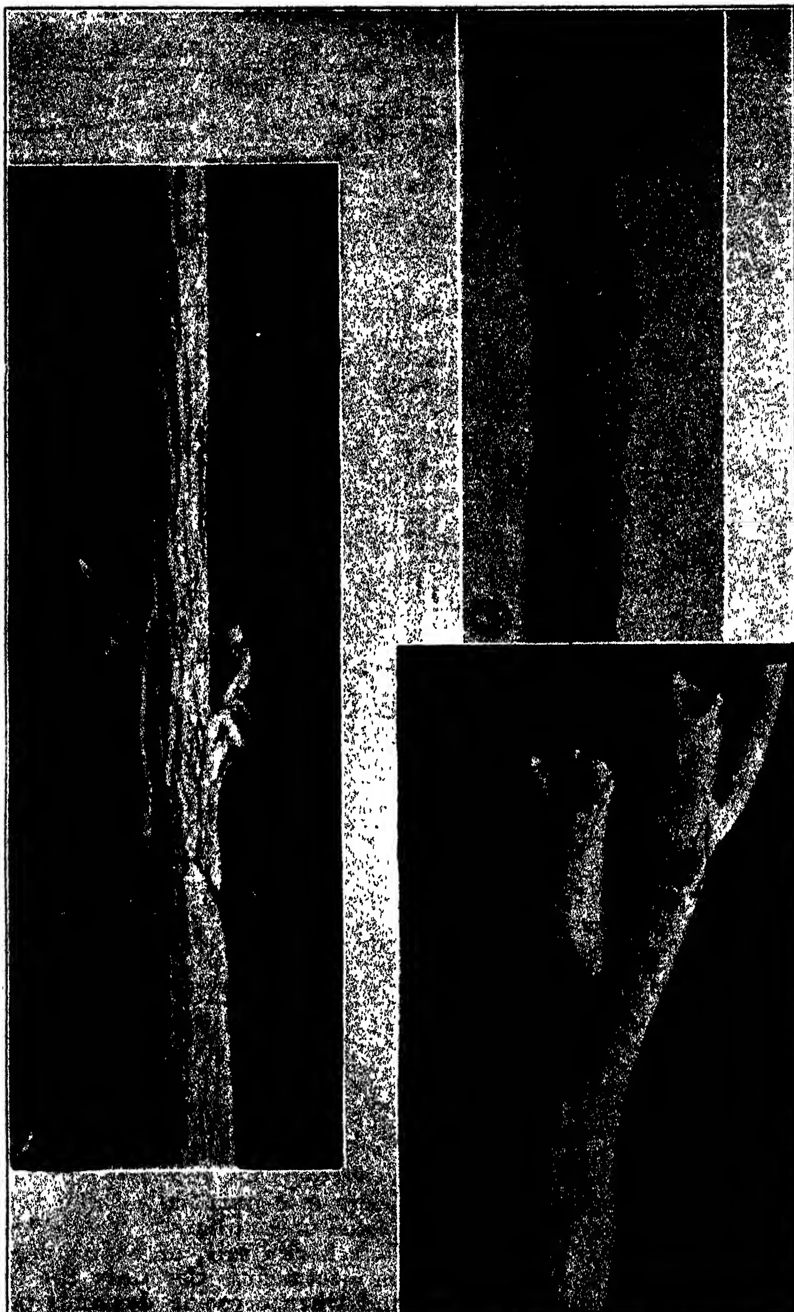


Plate No. XVIII. VARIOUS PHASES OF PRUNING. *Photo by Albert Kelly.*

1. A young privet stem (much enlarged), showing a pruning from within (×—×) made by the young grub, the photograph being taken before the upper part fell away. At V is seen a vent-hole through which the débris is ejected. 2. A privet stem (natural size), showing two final prunings and at A and B the holes made by the beetles upon emerging. The damage shown is a year old and a certain amount of callousing or new growth is to be observed around the exit hole. 3. An old privet stem (about half natural size), showing a final and more or less ineffectual pruning at V, and an exit hole, partly calloused, at ×.

remarkable horny, pointed appendage or tail (see Plate XVII, figs. 2 and 3). The little creature, at first but one-twelfth of an inch in length, in the course of time grows to a comparatively huge size, but throughout its life does not alter essentially in appearance. As soon as it enters upon an active existence it bores its way upwards, ordinarily to a distance of $1\frac{1}{10}$ inch* (see fig. 3, diagram 1, and Plate XIX, *B*). In all cases where the tip has been severed closer to the egg by the parent beetle, the larva tunnels up as far as it can without actually biting its way out, leaving but a thin shell between itself and the world outside. Arrived so far, the gallery is enlarged in diameter and the insect turns a somersault and begins to work downwards (see fig. 3, diagram 2). At about the time this turning in its track is made a small pinhole is bitten out through the bark near the apex of the

Fig. 3. The diagrams represent the initial work and movements of the newly hatched borer. [1] Shows the uptunnel made immediately after hatching. [2] The enlargement of its apex and the grub in position to bore downwards. [3] The grub in position (head downwards) after finishing its first down tunnel. [4] Illustrates how the grub backs upwards, tail first; reversed and comes down, tail first. [5] The grub resting, head upwards. [6] The grub, after its first moult, making its first pruning. [7] The grub resting after the pruning and the plugging of the open gallery. [8] Showing the enlargement of the gallery subsequently made to enable the grub to reverse its attitude. [9] The grub (head downwards) at the bottom of its second down gallery.

Note.—The subsequent behaviour of the borer is a continuous repetition of from [4] to [9].

uptunnel and from this the dry detritus is ejected, the pellets being flicked out one by one in quite rapid succession. This, at times, resembles nothing more than a number of tennis balls being thrown through a small round casement by some unseen hand. There is some reason for believing that the peculiar horny tail, of which mention has been made, plays a part in this ejectment. Certainly the insect is head down below the opening, and when occasion demands pellets can be passed up between the body and the wall of the gallery by succeeding muscular contractions.

* Uptunnels of $1\frac{1}{4}$ to $1\frac{3}{4}$ inch have been met with, but they are quite exceptional. $1\frac{1}{10}$ inch is the favourite distance from casual observation, but in seventeen cases, where no pruning had been done by the parent beetle and careful measurements were taken, it was found that two measured $\frac{7}{10}$ inch, seven 1 inch, two $1\frac{1}{10}$ inch, three $1\frac{1}{5}$ inch, two $1\frac{3}{10}$ inch, and one $1\frac{3}{4}$ inch.

The Sombre Twig-pruner.

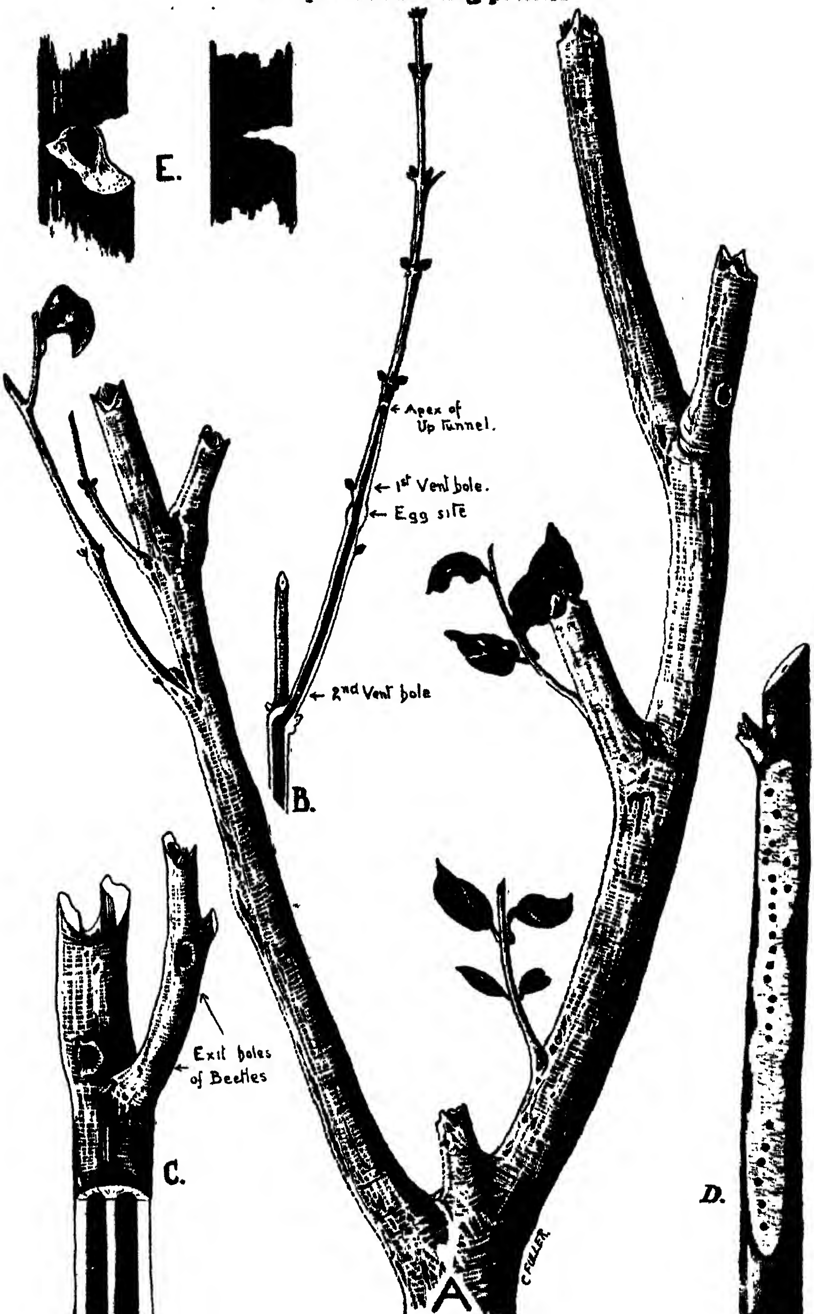


Plate No. XIX. FURTHER PHASES OF BORER PRUNING.

(All drawn from actual specimens.)

A. A privet branch (reduced), showing the final prunings of no less than six borers. *B.* A section of a young shoot, showing the primary tunnel of the young borer. *C.* A privet stem, showing two final prunings and two exit-holes of beetles. Portion is seen in section to show how the two insects accommodated themselves agreeably when their burrowing carried them into the same stem. *D.* A privet stem, showing a remarkable series of vent-holes. The lightened area represents a thin layer of bark overlying the tunnel. *E.* Two examples of incomplete pruning in large stems.

In enlarging its burrow to turn round the borer eats the tissue away to the bark, and the immediate consequence is that the stem dies off above that point and this portion sooner or later breaks away. These dead tips are the first readily recognizable indications of the insect's attack, and are most conspicuous in a green hedge of privet (see Plate XV, fig. 1).

The downward working is continued to a point between 1 and 2 inches below the site of the egg and there stops (see fig. 3, diagram 3). The borer then ascends its burrow, travelling backwards and making use of the old enlargement, or a fresh one made towards the upper end of the gallery, reverses its attitude, and backs downwards to the bottom (see fig. 3, diagram 4). Here it remains for some days, its excrement increasing below it. Presently it ascends to the point, as a rule, just below the site of the egg, or perhaps even above that point to half an inch, and there by a peculiar outward girdling prunes off the upper portion (see fig. 3, diagram 6). Having done this, it plugs the now open mouth of the gallery and retires downwards to moult its skin and rest (see fig. 3, diagram 7). Having once more acquired an appetite, it ascends the burrow and enlarges it, turns about and descends another stage (see fig. 3, diagram 9), when the same manoeuvres already noted are repeated. This is the remarkable feature of this insect's workings; it does not tunnel continually downwards, but progresses by a number of stages which appear to coincide with its various moults—boring downwards, reversing, moulting, pruning, resting, reversing, and boring downwards again until at last it finds itself in the fairly stout stem from which the twig in which it was born sprang.

THE PRUNING: ITS METHOD AND OBJECT.

The girdling of the twig from the inside is peculiar, and the same process is repeated upon each occasion that a pruning is made, that is, the principle is the same whether the borer is quite small or fully grown.

To obtain a practical illustration of this clandestine operation, a hollow stem should be selected and cut into two pieces by making from two opposite points two upward slanting cuts towards the centre; this gives the two-pointed after result which is so characteristic. This peculiar excavation of the inner wall is not easy to describe, either as to its nature or the exact method in which it is accomplished. After careful consideration and a little actual evidence, it is assumed that the borer, braced in its narrow gallery and revolving therein, bites into the wood of the walls, making a deep circular incision which reaches to the bark, except at two opposite points where a little woody tissue is left (see fig. 3, diagram 6). Taking the line between these two points as a base, it then excavates downwards, gradually narrowing the width of the work until a wedge-shaped portion has been removed on either side. This accomplished, the borer tears through the bark along the four descending lines of its excavation, so that on each side of the branch there is seen, from an exterior inspection, a V-shaped slit. (This is well shown in fig. 1, Plate XVII, the photograph being taken before the upper piece fell away. Figs. 3, XVIII; *A* and *C*, XIX; and 1 and 2, XXI, also show the details of the pruning.)

The supporting strands of woody fibre do not carry the practically severed portion for very long, and the work is frequently only just

The Sombre Twig-pruner.

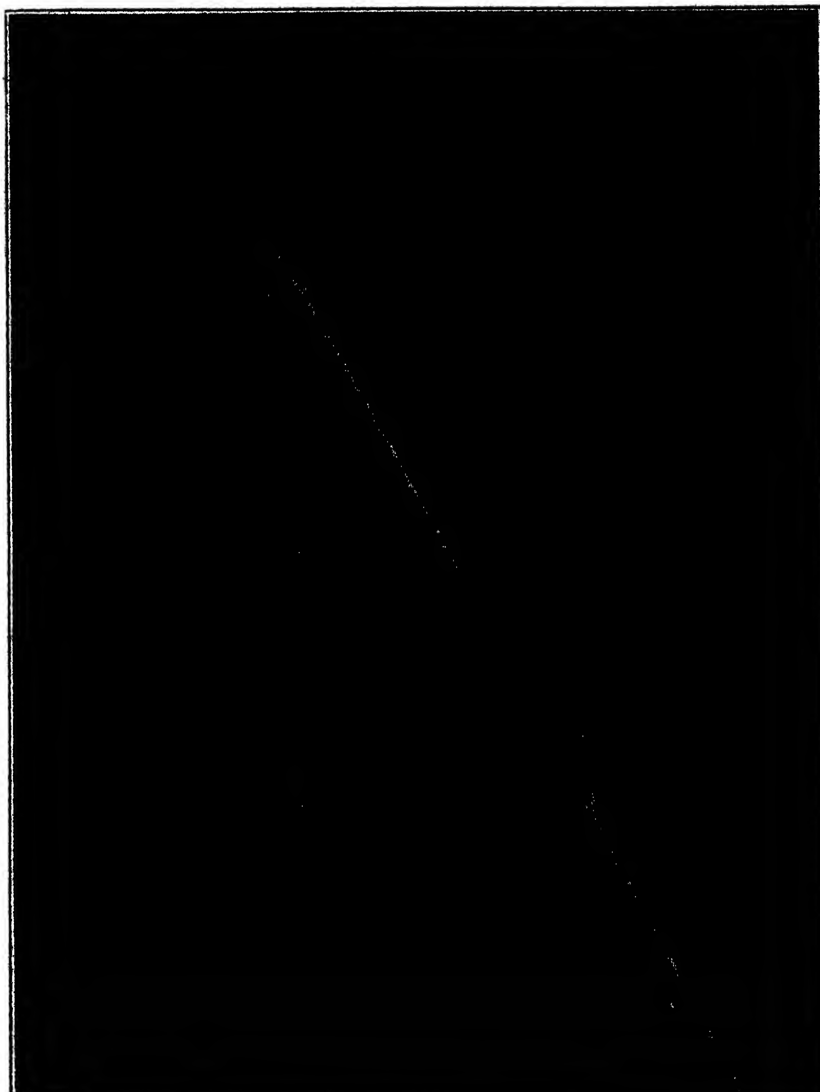


Plate No. XX. *Photo by Albert Kelly.*

AN UNUSUAL PRIMARY PRUNING.

A privet shoot (natural size), showing the first pruning by the borer. This is an unusual example, the insect having duplicated its work for some hidden reason.

done when the upper part breaks away. In other cases it may persist for a very long time, either through indifferent workmanship or owing to its being guyed up by surrounding stems.

After making a pruning the borer immediately proceeds to stop up the now wide open entrance to its gallery, and it is reasonably assumed that the object aimed at in not completing the girdling and of making it in the peculiar manner in which it is made, is to secure some cover for the creature whilst performing the essential task of plugging the opening (note plug in fig. 1, Plate XXII), for it must be remembered that even at the first cutting the opening is sufficiently large to admit a small ant.

Before considering the object of this pruning it is necessary to mention that in following down the core of the growth in which the egg is laid, the borer enters into the heart of the stem supporting it, and as frequently as not into the heart of a third. Naturally enough, it frequently finds itself ultimately in a stem of comparative thickness, perhaps in one of the old main stems of the privet of about three-quarters to an inch in diameter. As a general rule, there is a relatively fixed proportion between the diameter of the borer's body and that of the stem inhabited, and so long as this is the case the borer keeps to the heart of the stem and prunes it thoroughly. When this proportion is lost the insect makes its gallery to one side of the centre of the stem just below the bark and in the sap-wood. Under such circumstances the pruning operation is carried out upon similar principles, but the result is not to sever the limb but to make a gaping wound in its side (Plate XVIII, fig. 3, and Plate XIX, fig. *E*). This secondary form of pruning is described because it has some bearing upon the object of the operation.

This girdling of the stem from the inside is done by an American longicorn beetle (*Elaphidon villosum*), known popularly as the "oak-pruner," of which it is said:—

"The beetle lays each of its eggs in a small twig. The larva eats out the inside of this twig and works down into a larger branch, following the centre of it towards the trunk of the tree. . . . When full grown, the larva enlarges its burrow suddenly, so as to nearly sever the branch from the tree, leaving only the bark and a few fibres of wood. . . . It then retreats up its burrow a short distance and builds a plug of chips below it. The autumn winds break the branch from the tree, carrying the larva with it. It remains in its fallen domicile through the winter and undergoes its transformations in the spring."

Here we have a state of affairs like and unlike to that presented by the local pruner, but in the resemblances giving no direct clue to our inquiry. It, however, indicates that the moist conditions, which are the accompaniment of a direct flow of sap, are essential to the well-being of the local insect. This has been suggested in the case of the larva of the English aspen-borer (*Saperda populuea*), it being thought that the insect is nurtured upon the sap as well as the wood eaten. Indeed, this is the only explanation. It explains the initial pruning of the parent beetle (when performed), and the repeated prunings of the larva and the secondary form seen in the older branches? In short, without a certain amount of moist sap flowing towards and past it, the twig pruner is handicapped through the whole of its hidden existence in the privet stem. As illustrating

Plate No. XXI. *Photo by Albert Kelly.*

BORER TUNNELS.

1. A normal pruning and a normal burrow in a privet stem (natural size). 2. A normal pruning with vent-hole at ×, showing a cell prepared for pupation. A large plug of fibre is noticed at *b*. A similar plug existed below *a*, but has been removed to show the details of the foundation of these plugs as made by the borer. 3. Portion of a burrow (much enlarged), showing where shreds for forming the plug have been torn out of its walls.

this point still further, it has been repeatedly noticed in the case of stems cut in August and September containing fully grown larvae and pupae and placed in observation cases so as to secure the adults, that although the transformation was successfully accomplished, the adult beetles died in the burrows through sheer disinclination—I can hardly say inability—to eat through the thin but *dry* partition between it and liberty.

THE PLUGGING OF THE GALLERY AND THE MAKING OF VENT-HOLES.

It has been said that after pruning off a portion of the stem the borer plugs up the wide opening consequent upon the operation. Its early efforts are simple and ingenious. It gouges narrow shreds of wood fibre from the burrow walls just as one might do with a minute chisel, working upwards and leaving them attached at their bases. These are pushed upwards and bent sharply, so that they remain in position and acting as a kind of *cheval-de-frise* to prevent the ingress of any small enemy and even water (see Plate XVI, fig. 2, and Plate XXI, fig. 2).

Whilst this suffices very well when the grub is small, it is evidently soon found unsatisfactory, as after one or two prunings the plugs are considerably strengthened, so that they resemble quite excellent corks, which, starting as a few shreds, are gradually increased in depth somewhat in proportion to the creature's growth, until they may be an inch or more in length. In order to make these corks, it is found that the borer descends its galley and pushing upwards gouges out shreds of even a half and three-quarters of an inch in length, and carrying them forward jambs them home (fig. 3, Plate XXI, shows numerous channels formed by this gouging). It is to be noted, however, that the corks are always built upon, or rather built up under, partly detached shreds (see fig. 2, Plate XXI, from which the cork has been removed and only the original or foundation of it left).

It is well to state here that whilst primary corks are always found in the orifice, secondary corks are frequently made lower down in the gallery, especially where one or more vent-holes have been made through the walls.

Mention has already been made of the vent-hole cut when the larva makes its first descent; a hole bored with reasonable supposition for throwing out the excrement left in the burrow through which the larva retraces its steps. The holes that are furnished later on are used for throwing out the dried excreta, and as a rule they are made just below the cork or plug of the orifice. After making a pruning, we have seen that the larva descends to the base of its gallery and there rests—the moulting of the skin occurring during this period and a considerable amount of excreta accumulating below the insect. After turning upside down to work another stage of its gallery, the borer must pass through this excrement, and it is assumed that before commencing operations it cuts the vent-hole for the express purpose of getting rid of this matter.

If such were indeed the case one would expect to find the hole made some time after the pruning—and this is true as a general rule, and as much as twenty days may elapse after a pruning before a vent-hole is made. Upon the other hand, and in as many instances, a hole is made very shortly after pruning, but in these cases excreta

Plate No. XXII. *Photo by Albert Kelly.*

THE CHRYSALIS OR PUPA.

VENT-HOLES.

1. Section of a pruning, showing the chrysalis in the burrow. This illustrates a favourite location of the chrysalis, but one which does not always occur. 2. Privet stem (natural size), showing a series of vent-holes, a partial pruning, and a beetle exit-hole.

is seldom thrown out, and the gallery is often filled by a second plug. Perhaps in these cases a mistake is made, that is, the stimulus to do so acts prematurely. Frequently a series of vent-holes are found usually a tenth of an inch or so apart, and varying in number from two to twenty (see fig. *D*, Plate XIX, fig. 2, Plate XXII, and fig. 1, Plate XXIII). Where a large series of these holes exist the gallery will be found to have been considerably widened, and there can be little doubt that the object is to get rid as speedily as possible of the rapidly accumulating débris and excreta. From all this it would appear that the borer displays remarkable cleanliness, and this is indeed so, but there is little doubt that this cleanliness has for its object the prevention of fermentation and decay of the walls of the gallery from which the larva, whilst resting, probably absorbs a considerable abount of sustenance. When the borer is "sitting up" in its gallery the excreta can only accumulate behind it, but this, it has been shown, is usually ejected; at the same time it has been noticed that where the top of the gallery is drying out it is frequently filled for quite a distance with excrement, presumably to save the extra trouble of ejectment. Such accumulation may be kept in place by an extra plug below it.

The numerous vents made by the borer throughout its working existence are all attained by a countersinking into the wall of the gallery, which operation is continued until a perforation is accomplished. This is illustrated at ×, fig. 2, Plate XXI. There is no reason to assume that they serve any other purpose than for the disposal of the pellets which, beneath an infested hedge, at times litter the ground as profusely as if strewn with sawdust. What is difficult in connection with them, however, is to put some explanation upon the series of many at short distances apart, which the creature makes as it grows larger. These do indeed seem unnecessary, for it is surely more laborious to make a vent than to propel the pellets even several inches further upwards. One must conclude that as it grows older the insect feeds in this peculiar manner upon the substance of the walls of its gallery.

BORER VAGARIES.

Instinct—Intelligence.

In following more or less closely the workings and behaviours of this borer one cannot help being much struck with the many eccentricities presented. The insect does this or that, or leaves this or that undone, and the rhyme and reason of it all is as often mysterious. Much that is done is obviously instinctive, and many other things such as are usually credited to the influence of obscure stimuli. Some of these latter manifestations have every semblance of intelligence, and from them, if one so chose, mental calculation or reason might be inferred.

There is no more debatable ground, however, than the ascribing of any form or glimmering of intelligence to insects. Man enjoys a monopoly of intellect, but he retains traces of instinct. The lower animals are granted both intelligence and instinct; but further down in the scale intelligence disappears and is replaced by instinct, and the lower we descend the further does tangible evidence of even instinct become occluded. But something—some force always remains—the attribute of "life" as we define it.

Plate No. XXIII. *Photo by Albert Kelly.*

BEETLE EXIT-HOLES.

1. Reduced. 2. Natural size, showing the exit-holes (×) of adult beetles as they appear just after the insect has made its escape.

So, just as man traces his animal ascent by his bones and his structure from lowly organisms, so our modern philosopher traces the evolution of intellect from the most lowly manifestations of "mind force." Just, therefore, as there are no sharp dividing lines anywhere in the scheme of nature, so there is no reason whatever to make a distinct break between instinct and intelligence, but rather to look for glimmerings or manifestations of a transitional stage, being careful, however, not to range these displays, when found, alongside of intellect nor the high grade of intelligence, the so evident possession of many animals.

A certain connection has been established between the act of pruning and the moulting of the grub. That is, we know that having recovered strength after the casting of its skin the borer makes a pruning prior to a further extension of its burrow. The object of this is not incomprehensible. But many other prunings are made which do seem to have no particular object. The making of such may be misdirected energy, but that cannot be said dogmatically. As a matter of fact, the pruning had a wearying inconsistency.

In one instance a young borer made an initial pruning, cutting off the twig an inch below the egg-site. This action was quite normal and one which commonly occurs. But within a day it made another pruning, a quite unusual feature, half an inch below the first (see Plate XX). As if to emphasize its dissatisfaction with its surroundings, it immediately proceeded to make a third pruning a quarter of an inch lower down. Some almost parallel cases were observed, but they were exceptions and not the rule.

After making many manipulations with borers, young and old, I have come to the conclusion that for some little time prior to and immediately after moulting, the creature is actually unable to behave exactly as it would if acting from instinct or some stimulus causing it to behave with appearing intelligence.

Over and over again twigs have been split to note the position and actions of the borer, and this done, the split portions have been carefully bound together again. Such resulted in many curious phases, some of which are recorded as of interest.

In one case, in handling a growing twig it broke half through at the site of the egg, but remained well attached with a slight cant out of the perpendicular. This had not been pruned by the parent beetle and was similar to that at fig. 1, Plate XVI. At this time the newly hatched borer was making its initial or only "upward" burrow.

When this twig was examined a month later it was discovered that the grub had returned to the egg-site—as proved by the presence of the vent-hole there to expel the débris—and, finding itself unable to bridge the gulf which accident had created, returned and ate out a gallery eight inches in length towards the tip of the twig. It was seen resting half-way along the burrow with its head upwards, so that it had instinctively assumed the normal attitude for moulting, and intelligently preserved its life by feeding on tissue usually neglected.

The portion of the twig containing this larva was cut with a long slant and matched to a living twig (which was hollowed a little) and tied on securely, grafted in fact. All the insect did was to back downwards and apply its body to the green base of its now artificial

cell. Here it stayed for twelve days, when it enlarged its cell, turned round, and burrowed downwards into the green wood. The artificial condition in which it passed twelve days could not possibly be looked upon as ideal, and it is assumed—on other evidence as well of course—that my manipulation took place at the period when the insect was naturally inert.

In working with large larvae, in cases where the twigs were split and the insects found busily tunnelling downwards and the splits then bound up, the insects invariably pruned off the split portion and made a new plug and vent within twenty-four hours. On the other hand, where the operations revealed the larvae resting in the upright attitude no effort was made to repair the damage, and they remained for days indisposed and unreacted upon by the unusual surroundings; that is, the open gallery and the excessive transpiration of the split portions.

The actions of the burrowing larvae can be ascribed to instinct or to the reflex action of the intervening stimuli in preference to intelligence, if one so wishes, but not so easily as some nearly parallel cases. These were such where it was necessary to transfer larvae from one stem to another, and it so happened that I had four stems which had been cut off clean with the knife just below the plug and from which the grubs had been removed without splitting. Other feeding borers were introduced into these domiciles, head downwards. They explored the burrow, then enlarged it to turn about. Proceeding upwards, they plugged the artificial orifice, made a vent, again turned about and went on burrowing downwards. Possibly they were deceived as regards the knife pruning of their new domicile, but some ray of intelligence is seen in their actions. The plug was gone and it had to be replaced at considerable inconvenience.

It was soon found quite as easy to make observations on the pruners by keeping infested stems in water. Naturally, these were seldom of sufficient length to accommodate the borer indefinitely. In about a hundred cases not one larva burrowed out through the cut base of the stems; but all, whether that base was one or four inches deep in the water, burrowed to the very base and left a thin partition between them and the water. They then turned about and "existed" for days in a more or less submerged state until at last driven to subsist upon the walls of their gallery, the tissue already passed through, but leaving always the bark to prevent a total flooding of the cell, not even expelling their excrement, and ultimately, of course, dying either from starvation or the fermentation and decay of their habitat.

THE PUPA STAGE.

There is little to be said regarding the pupa or chrysalis stage of this insect. The pupa as a rule rests in the apex of its final burrow, and usually that apex coincides with a bend where the tunnel has been driven from one twig into that supporting it. This elbow enables the insect to rest upon a sort of shelf, as seen in fig. 1, Plate XXII. Similar pupation sites, or elbows, are to be seen in three cases of fig. *A* and one in *C*, Plate XIX, and in both figs. 1 and 2, Plate XXI. In straight stems the pupa is often able to rest comfortably at the apex, because many are out of the perpendicular. Thus, for example, the pupa was at the apex of the stem seen in fig. 1, Plate XXI. In the case of fig. 2, Plate XXI, the stem stood quite

perpendicular, and under these conditions it is noticed that a lower plug or bed (*b*) has been built up so that a cell was formed. (It has been pointed out elsewhere that in the case of this example the upper plug has been removed to show its foundation.)

THE EMERGENCE OF THE ADULTS.

Arrived at the beetle stage, the borer does not immediately leave the stem, but rests within for some time, sometimes as long as a whole month. It then bites its way out through the surrounding shell, leaving a clean-cut hole (figs. 1 and 2, Plate XXIII). These holes persist in the plant, and although they callous slightly around the edges, as seen in figs. 2 and 3 of Plate XVIII and *C* of Plate XIX, they never completely close up. The galleries, too, remain open, but in vigorous plants are often nearly filled up with cell growth.

Seemingly the adults are stupid and do not exhibit any of that adaptation to an unusual environment so often seen in the borer stage. For, if sticks be collected when pupae are most common in them and allowed to dry out, the beetles will die in the cells without making any attempt at biting through the thin wall that lies between them and liberty.

Weenen Phosphates.

REPORT BY THE CHEMIST.

THE following report on samples of phosphatic rock taken in October at Weenen, Natal, has been presented to the Secretary of Agriculture by the Chemist of the Department, Mr. H. J. Vipond:—

The phosphates will be dealt with in two groups:

(1) The Kaffirskraal and Baviaans Krantz claims (including Smit's).

(2) The Harding's claims.

The sampling of the first group was carried out very thoroughly and that of the second group also fairly thoroughly, but a great deal of time and labour was required to accomplish this. Wherever possible unweathered rock was taken, but in some cases we had to be content with partially weathered material, and one or two samples of weathered stuff were also taken for comparison.

Group 1: Kaffirskraal and Baviaans Krantz (including Smit's) Claims.—All the deposits sampled on these claims were of a similar nature, except for one or two badly weathered beds whose original nature we could not ascertain. They all consist of hard blue-grey, fine-grained rock of a sandstone nature. The beds are on an average

6 to 9 inches in thickness, and in many cases are lenticular, thinning out and reappearing. They are separated from each other by several feet of shale.

(a) Kaffirskraal Claims.

Donga on east side of claim:—

Sample No. 1.—Bottom reef, hard blue rock, which seems to "weather" very little. There are three beds close together here, and then 30 or 40 yards with no bed.

Sample No. 2.—Taken 40 or 50 yards higher up from No. 1; also hard blue rock like No. 1.

Sample No. 3.—Taken from a reef about 6 feet above No. 2; similar to No. 2.

Sample No. 4.—Taken about 150 yards higher up donga; slightly weathered.

Sample No. 5.—From same reef as No. 4; hard and unweathered.

Sample No. 6.—Second reef from top of donga, taken about 2 feet into wall of same, but still badly weathered. Hard, greyish, brown rock.

Donga on west side of claim:—

Sample No. 7.—Bottom reef in donga, average thickness about 8 inches; hard blue rock like Sample No. 1. The next reefs occur about 50 yards from bottom of donga.

Sample No. 8.—Second reef, about 50 yards above Sample No. 7; similar in appearance.

Sample No. 9.—Third reef; similar to Sample No. 7.

Sample No. 10.—Fourth reef; slightly weathered.

Sample No. 11.—Top reef, taken in side of donga; badly weathered.

Sample No. 12.—Top reef, taken where it lies on the surface; very badly weathered.

(b) Baviaans Krantz (including Smit's) Claims.

Sample No. 14.—Soft surface limestone, said to be phosphatic, taken at large waterfall.

Sample No. 15.—Smit's claim, taken from a layer up to 15 inches thick; hard blue rock like Sample No. 1, etc.

Sample No. 16.—From reef at base of krantz; hard blue rock.

Sample No. 17.—From reef on level with top of krantz; hard blue rock unweathered.

Sample No. 18.—Same reef as No. 17, but weathered.

Sample No. 18A.—Taken from heaps at mill, originally from Baviaans Krantz.

Group 2.—Harding's Claims.

Samples Nos. 19-21.—From second reef from bottom, about 10 inches thick; dark, soft, shaly material.

Sample No. 22.—Third reef from bottom, 6 to 7 inches thick; dark, soft, shaly material.

Sample No. 23.—Also from third reef, 3 to 4 inches thick; hard material showing white incrustation on weathered surface.

Samples Nos. 24 and 25.—From fourth reef from bottom, about 8 inches thick.

ANALYSES.

Group 1.—(*a*) *Kaffirskraal Claims.*

No. ...	1	2	3	4	5	6	7	8	9	10	11	12
	%	%	%	%	%	%	%	%	%	%	%	%
Moisture ...	·14	·16	·24	·09	·12	·61	·18	·22	·14	·66	·76	·64
Loss on ignition	20·82	18·96	15·16	14·88	18·33	11·56	17·48	17·54	14·82	8·53	9·36	8·92
Insoluble ...	31·88	34·18	45·52	44·45	36·03	43·28	36·35	31·02	34·38	33·19	40·74	47·12
*Phosphoric acid	1·76	3·10	1·65	2·05	1·45	2·92	2·55	4·72	7·00	7·75	4·06	1·54
Lime	9·70	11·85	6·23	5·97	6·56	10·58	9·37	—	17·81	14·46	10·56	—
Iron oxide and alumina	Not determined					26·80	29·99	—	20·99	29·36	31·98	—
Magnesia ...				Varies from about 2% to 5%								
	—	—	—	—	—	95·75	95·92	—	95·14	93·95	97·45	—
*Equivalent to phosphate of lime	3·87	6·82	3·63	4·51	3·19	6·42	5·60	10·20	15·40	17·05	8·92	3·38

N.B.—The figures for iron oxide and alumina are obtained by taking half the weight of the precipitate of iron and aluminium phosphates.

None of the above samples are worth exploitation for the manufacture of superphosphate. These samples, it will be noted, are nearly all hard blue rock, the exceptions being Nos. 6, 11, and 12, which have a weathered appearance.

Group 1.—(*b*) *Baviaans Krantz and Smit's Claims.*

No.	14	15	16	17	18	18A
	%	%	%	%	%	%
Moisture	·57	14·55	15·45	20·95	15·70	11·05
Loss on ignition	36·76					
Insoluble	12·24	41·43	42·00	29·21	33·32	47·15
*Phosphoric acid	trace	3·45	4·17	1·62	2·90	4·65
†Lime	45·35	18·14	20·70	9·68	14·57	18·32
Iron oxide and alumina	3·07	20·45	—	36·90	31·54	16·84
Total	97·99	98·02	—	98·36	98·03	98·01
* Equivalent to phosphate of lime ...	—	7·60	9·18	3·56	6·38	10·23
† Carbonate of lime	81·00	—	—	—	—	—

No. 14, it will be remembered, is a sample of soft white surface limestone.

No. 14.—This should be well worth while to grind for agricultural purposes, as it is soft and of fair quality.

Group 2.—Harding's Claims.

No.	19–21	22	23	24 25
	%	%	%	%
Moisture and loss on ignition	9·22	9·34	6·18	10·26
Insoluble matter	50·14	—	21·52	45·25
*Phosphoric acid	1·74	7·94	22·20	1·06
Lime	6·37	--	35·00	11·24
Iron oxide and alumina	30·97	—	11·82	28·90
Total	98·44	–	96·72	96·71
*Equal to phosphate of lime	3·82	17·47	48·90	2·33

No. 23 is the only sample with a good percentage of phosphoric acid, but this is marred by the high percentage of iron oxide and alumina which it also contains. This was a picked sample from a thin portion of a reef, and it was at the request of Mr. Barron that I undertook to analyse it separately, as he considered it a very promising sample.

The reefs on this claim are dark, soft, and shaly, and are in fact only distinguished from the shale by the fact that they weather reddish and stand out on account of slightly greater hardness and resistance to weathering.

The above claims are all that I was able to make a personal inspection of and to sample properly. Some samples of wood phosphate, and one sample which I was given to understand was from what is called the "pony" reef, were supplied by Mr. H. Lyons, and these were considerably richer than the average of the samples given above. Not having any personal knowledge of these deposits, however, I do not feel at liberty to give the results to the public.

The beds actually sampled average from 3 to 4 per cent. of phosphoric acid, whilst the minimum for commercial success in the manufacture of superphosphate should be over 20 per cent. In addition they contained an overwhelming amount of iron oxide and alumina which alone would render them useless for that purpose.

Finally, I may say that during my stay at Weenen I was entirely in Mr. Lyons' hands, and whatever deposits I examined and sampled I did so at his suggestion and by his arrangement.

The representatives of the Natal Farmers' Co-operative Union, under Mr. Lyons' guidance, inspected only the Kaffirskraal and Baviaans Krantz deposits, which are represented by Samples Nos. 1 to 18A. I was given to understand that a full report on these claims would be sufficient for the time being.

H. J. VIPOND.

The Establishment and Cultivation of a Vineyard.

By Dr. A. J. Perold.

(*Continued from page* 50.)

VII.—HOW MUST I TREAT THE VINE ITSELF?

For the treatment of the vine against vine diseases I refer the reader to my article on "The principal diseases of our vineyards" published in the October number of 1910 of the *Cape Agricultural Journal.* Copies of reprints of the above article can be got gratis from my office.

The pruning and trellising of the vine is one of the most important things which here require our attention.

According to the local circumstances, the variety of grape and the aim one has in mind, the vines must either be pruned short or long, and the sticks kept close to the ground or trellised high.

One can distinguish between

A. Vines with short bearers standing free.
B. Vines with short and long bearers standing free.
C. Vines each with a stake.
D. Vines trellised on wire.

Method A is the one mostly in vogue in hot countries (France, Italy, Spain, Tunis, Algeria, and South Africa). In these parts the vines are usually planted further apart than in more northerly parts, and the vines are then usually big and strong enough not to require any support.

The first year, i.e. nearly one year after they were planted, one prunes the vines so that every stick gets but one bearer with two eyes. The second year the vine gets two bearers with two eyes. In the third year one can give the sticks two, three, till four bearers, each with two eyes, according as the vines are weaker or stronger. It is wrong to cut the spurs longer than two eyes, as the eyes at the basis then usually do not sprout, hence nothing is gained hereby, and one only soon gets high vines at the expense of their good form and stability. From now the vines by and by get five to six and even eight bearers (spurs). Sometimes vines can be found with even more bearers, but I cannot see the advantage of it. From figures 4, 5, and 6 it can clearly be seen how the vines have to be pruned.

When pruning, mainly three things have to be remembered:—

(*a*) The shape of the vine;
(*b*) the bearers;
(*c*) the future bearers.

In the first place, the young vine must be pruned so as to raise it above the ground as quickly as possible and to give it a high stem to prevent the grapes from reaching the ground. Therefore, cane *a* in figure 4 was cut away, and cane *b* left as bearer. Here, therefore, a cane is chosen which stands high and has grown upright. If one

wishes the stem longer, then one can give the vine a bearer with three to four eyes, and break off the lower sprouts as they come out. In the following year two high equally strong canes are picked for bearers, which are as nearly as possible in one line (really in one plane). The bearers are again given two eyes, and the "oude nagel" *c* is removed, as shown by the dotted line. Should the vine be strong enough in the third year, four bearers are given. In any case, one should try to distribute the bearers as evenly as possible on the stick, and keep the middle of the vine open. The French call this system of pruning "taille en gobelet," i.e. cup-pruning, since the middle of the vine resembles a cup. When pruning one should consider the stability of the vine. Therefore, one should choose the bearers so that they stand fairly upright as *a* and *b* in figure 6, or have a somewhat slanting position as *c*, figure 6, but never so that they point in a horizontal or a downward direction.

Strong, healthy bearers should be chosen in so far as this is possible, always remembering what was said above. Sometimes a less good cane has to be taken on account of its favourable position and taking the future bearers into consideration. This is, however, so

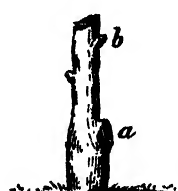


Fig. 4.

Fig. 5.

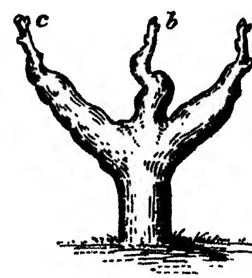


Fig. 6.

important that one should not hesitate to sacrifice some bunches of grapes on account of it.

Re the pruning itself, it must be observed that the work can be performed by pruning-knives or by pruning-shears. A much smaller cut (wound) can be made with a pair of shears than with a knife. The cuts *a* and *b* in figure 5 can only be made so short with a pair of pruning-shears. With the knife the cut can only be made as short as may be seen at *b*, figure 4. Generally, cuts made by a knife are still more slanting than shown in the figure. Since it is desirable to make the wound as small as possible, preference is frequently given to shears. One often hears it said that the pruning itself can be performed quicker with a knife than with shears. I think this is only a matter of custom. It is important to make the cut approximately half an inch above the eye. One may also cut through the following joint, but this does not look nice when the nodes are far apart.

When must I Prune my Vineyard?

Generally, it may be said that one should wait in any case till some soaking rains have fallen. Some farmers do some preliminary pruning during April and May, that is to say, that everything is removed from the vine barring the bearers or barring the bearers and

the "old bearers." (If an arm has two canes, as *a* and *b* in figure 5, then *b* is called the bearer and *a* the "old bearer," which is removed when pruning, unless *a* on account of its better position is left as bearer and *b* is cut away, or both left as bearers, in case one wants to "put on" an extra bearer.) I have no objection to the above practice if the work is done after the leaves have dropped and at a time when the vines do not bleed too much. Since this work is almost always done at a time when no other work has to be done on the farm, and since the final pruning is thereby accelerated to a great extent, lots can be said in favour of this way of pruning. The main

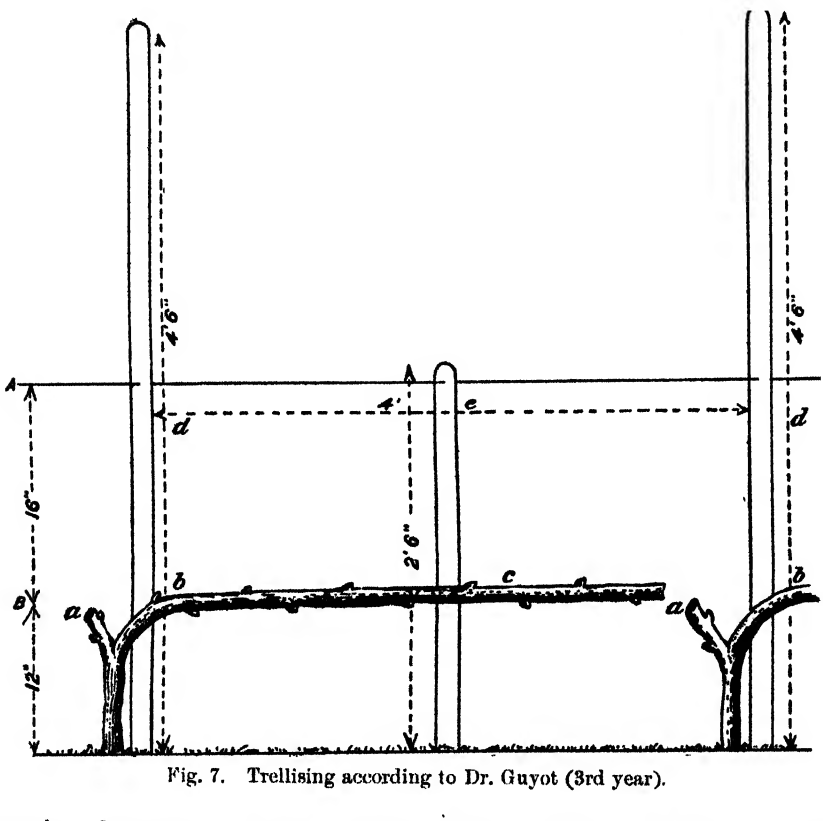


Fig. 7. Trellising according to Dr. Guyot (3rd year).

question, however, remains: When must I perform the final pruning of my vineyard? Most vineyards in our south-westerly districts are pruned between the 15th July and 15th August. Some farmers wait till the end of August or till the vines already start budding. Hereby one wants to let the vines bud later in order to protect them as much as possible against *Anthracnose*, non-setting of berries, as well as spring frosts. Although opinions differ on this point, it nevertheless seems fairly certain that one can retard the budding of your vines by eight to fifteen days through late pruning (shortly before or during budding). Since vines pruned late bleed a lot, they are somewhat weakened thereby on the long run. For this very reason it is a good thing to adopt late pruning in case of very vigorous vines which bear badly. They are thus weakened and bear better, the more so if one

gives them many bearers. On the other hand, vines pruned early bud early.

Let us now consider the remaining systems of pruning.

B. UNSUPPORTED VINES WITH SHORT AND LONG BEARERS.

In case of certain varieties of grapes (for instance, Sultana, Cabernet Sauvignon) one is obliged to leave some long bearers (ten to twelve eyes or more) to have a proper crop. In this case three or four canes—more or less evenly distributed around the vine—are bent towards the centre of the vine and fastened to each other. For every long bearer a spur with two eyes is left to provide for the long bearer and spur for the following year. The long bearers are then removed as close as possible to the trunk. Sometimes two long canes are twisted together, thus forming an arch. In case of vigorous vines two such arches are twisted which cross each other.

For the rest the same general remarks made under system A apply to this system as well as to the following systems.

C. VINES EACH WITH A STAKE.

This system of pruning I have not yet seen adopted anywhere in South Africa. In Central Europe (Champagne, Burgundy, along the Moselle and the Rhine, Switzerland, North Italy, etc.) most vines are trained along stakes. (At the same time one finds also many vines trellised on wire in the above-mentioned parts.)

In case of this method of training one usually gives the vines short and long bearers, whereby the spurs have got to provide the future bearers, whilst the long bearers really are the fruit-bearers. Since this method is not practised in our country, and since we, moreover, have no reason to adopt it in future, I do not wish to go into further details about it.

D. VINES TRELLISED ON WIRE.

Of late years trellising on wire has locally been much more adopted than in the past. I positively believe that those varieties of grapes that require to be pruned long, and principally table varieties, will more and more be trellised on wire. One should, of course, take care not to let the vines bear too much, as they will then be weakened, and the quality of the grapes will suffer.

There are four methods of trellising on wire which I wish briefly to discuss here. The first is:—

(1) *Trellising according to Dr. Guyot* (*"Taille Guyot"*).

According to this method, each vine is given a spur with two eyes, and a long bearer with approximately ten eyes. In figure 7, *a* is the short and *bc* the long bearer. At each vine a stake (*d*, figure 7) has to be placed which stands about 4 ft. 6 in. above the ground. To this stake the long shoots (Q, R, figure 8) of bearer *a* are fastened. The first wire is spanned approximately 12 inches above the ground (figure 7, *d*). The long bearers are trained along it and are tied to it. It must, therefore, support the weight of the grapes. Dr. Guyot recommends to have a shorter stake between every two vines (figure 7, *e*) to help in supporting the weight of the grapes. I consider this, however, as unnecessary. The stake is 2 ft. 6 in. above the ground. A second wire is fixed 16 in. above the first, and hence 28 in. above the ground (fig. 7, A). To this wire the shoots of the long bearer are

fastened, as may clearly be seen from figure 8. The pruning in the fourth year is now very simple. The dotted lines P show where the canes should be cut. One sees that the old long bearer is cut off close to the trunk. Cane R now becomes the short bearer with two eyes, and cane Q the old one with ten (or more) eyes, which now in its turn is bent and fastened to the lowest wire. In this way each vine gets every year its short and long bearer. Sometimes the stick is divided into two halves, each half getting a short and a long bearer. In this case one long bearer is led to the right and one to the left. Here one can plant the vines 6 ft. apart in the row without the length of the long bearers having to exceed 3 ft. When leaving only one spur and one bearer on each vine (see figure 8), the vines should not be planted further apart than 3 ft. 6 in. to 4 ft. in the row, as otherwise the long bearers would have to be pruned too long.

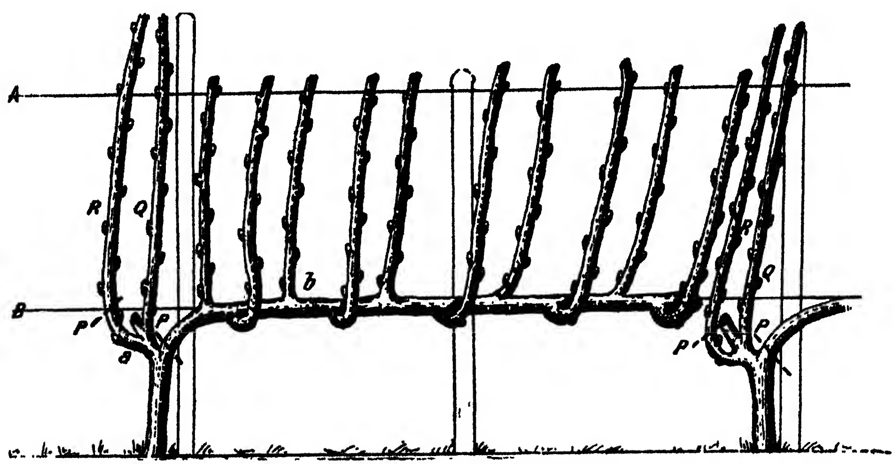


Fig. 8. Trellising according to Dr. Guyot (4th year).

(2) Trellising according to Cazenave.

This is undoubtedly one of the best methods of trellising vines. The sketches in figures 9 to 12 clearly illustrate this system. The distance between the vines and also between the stakes can be from 6 to 12 ft. Three wires are spanned in such a way that the first wire is 20 in. above the ground, the second 14 in. higher, and the third 16 in. higher than the second. In the first year the vine is given one spur with two eyes as everywhere. In the second year one long cane is trellised as a permanent trunk on the first wire until past the bend of the second vine. Should the vine still be too weak this can possibly only be done in the third year. On the permanent trunk in the following year canes *a*, *b*, *c*, *d*, *e*, *f* are selected at regular intervals of about 1 ft. as the long bearers, which are fastened to the second wire and are given an average of six eyes. Some canes (as *e* on the first and *f* on the second vine of figure 10) which are too weak are given only two eyes. In the preceding summer the shoots were fastened to the top wire and topped about 1 ft. above the wire.

On figure 11 we see two successive arms on the permanent trunk as they are in the following year before being pruned.

The first arm shows the result of a bearer which was given six eyes in the preceding year, whilst the second arm shows a bearer which was given only two eyes. The dotted lines P illustrate where the different canes should be pruned. Hence one now leaves a short bearer with two eyes (figure 11, A) and a long one with six eyes (figure 11, B), whilst the "oude nagel" is removed, as shown by the dotted line P. The long bearer B is now fastened to the second wire.

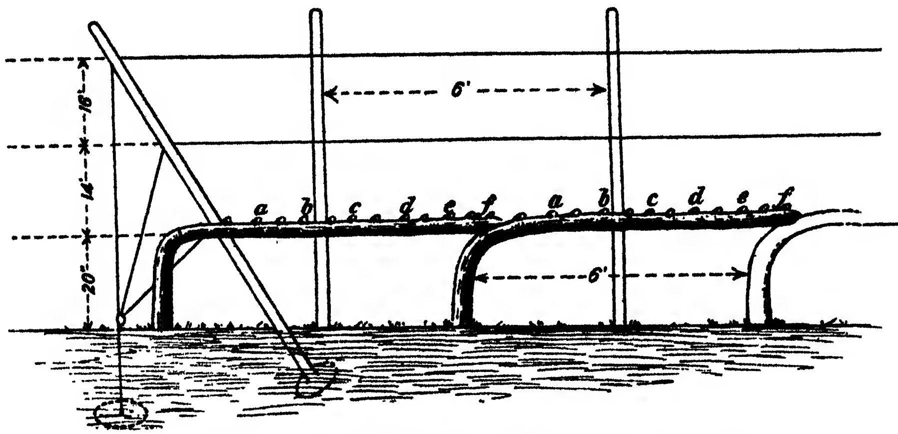


Fig. 9. Trellising according to Cazenave (2nd or 3rd year).

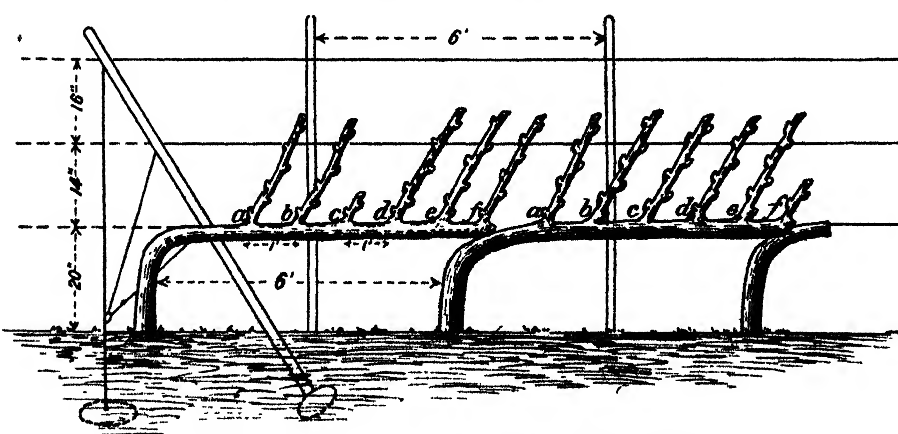


Fig. 10. Trellising according to Cazenave (3rd or 4th year).

In the next year every arm presents itself more or less as shown on figure 12. For the sake of clearness not all the canes are given, whilst those on bearer C are only shown as single lines. Now bearer C is taken away close to the trunk. A and B are pruned at the dotted lines P and remain as the short and long bearers respectively. The long bearer B is now again fastened to the second wire. Each arm on the permanent trunk is pruned year after year in such a manner as is shown in figure 12. If the arm in course of time gets too long, it can be cut back, and one simply leaves one of the lower shoots as a long bearer, as was the case in figure 10. In the following year figure 11 applies again and then figure 12 for the rest.

This system gives excellent results, and can be highly recommended. The crop is a big one, and the grapes are of good quality. Further, only 2500 or 1875 vines respectively are necessary per morgen if they are planted at a distance of 6 ft. by 6 ft. or 6 ft. by 8 ft., whereas if the vineyard is planted 4 ft. 6 in. by 4 ft. 6 in. or 5 ft. by 5 ft. respectively, 4444 or 3600 vines per morgen are required. The vine also grows more vigorously, and its life will be longer by letting it develop a lot of shoots (as is the case with this method of trellising) than when it is pruned short according to the system first discussed.

The lowest wire, on which the permanent trunks rest, must be No. 15 or 16, whilst the middle and top wires may be somewhat thinner (No. 12 or 13). One should use galvanized-iron wire which consists of one wire or of several thinner wires twisted together.

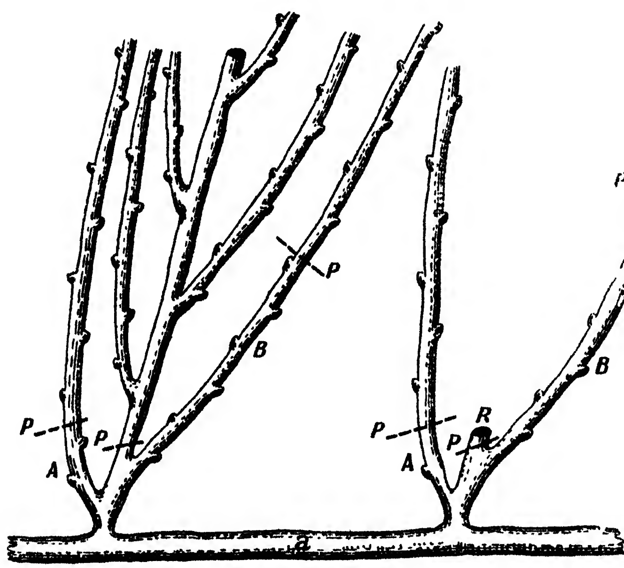


Fig. 11. Trellising according to Cazenave (4th or 5th year).

(3) *The Italian Fish-spine Method of Trellising.*

This method of trellising resembles very much that of Cazenave (the method above described). The only difference between them is that the middle wire is omitted and two wires are spanned approximately at the height of the lowest wire, and on each side approximately 15 to 18 in. away from it. These outside wires are, therefore, $2\frac{1}{2}$ to 3 ft. apart. They are kept in position by crossbars, which are fastened to the standards. As is the case with the Cazenave method (figure 9), the first thing to do is to get the permanent trunk. On this trunk canes are left as bearers about one foot from each other. The young shoots are fastened to the top wire. It must be $1\frac{1}{2}$ to 2 ft. above the lowest wire, whilst the latter has to be approximately 12 to 15 in. above the ground. The shoots have to be topped about 1 ft. above the top wire. In the following year the bearers are given two eyes, and are pruned 1 ft. apart from each other on the permanent trunk. The bearers are then all like figure 10. *c*, of the first vine.

Following pruning time, the arms are pruned according to the second arm of figure 11, only with this difference that the long bearers are fastened alternately to the right and to the left outside wire instead of to the middle wire (as with the Cazenave method), which here is dispensed with. The young shoots of the short bearer are fastened to the top wire, and provide later on the short and long bearers, as may be seen from figure 12. Here also the long bearers are removed close to the trunk. The only difference between these two methods of trellising lies in the fact that the long bearers are here bent and fastened to the outside wires, whilst with the Cazenave method they remain upright and are tied to the middle wire. The result obtained by this method is, of course, a trellis of about 3 ft. wide and quite 1 ft. above the ground. In Italy I have seen good results obtained by this method. Grapes that are easily burnt by the sun, if trellised according to this system, will be very much less exposed to the sun. The question is whether they will in this case get enough colour. I specially here think of the flame-coloured Tokai.

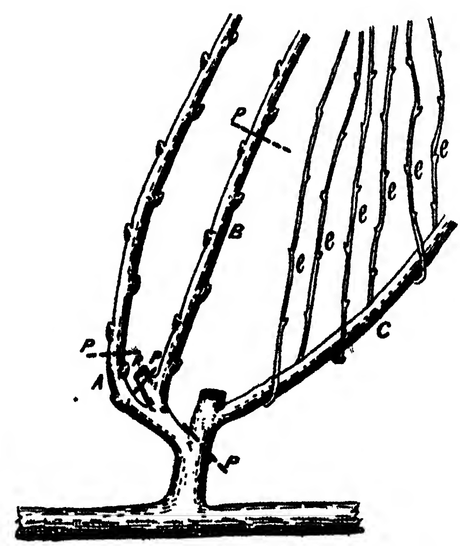


Fig. 12. Trellising according to Cazenave (5th or 6th year).

(4) *Almeria System.*

This system of trellising is in vogue in Almeria (Spain), where the Almeria grapes are grown according to this system. We here have a trellis which represents a horizontal plane at a height of 7 ft. The iron standards must be 8 to 9 feet long. For the outside frame (A, B, C, D, E, F, G, H, K, M) strong iron standards have to be used, weighing 50 lb. and 8½ ft. long. Each of these standards must be kept in position by wire anchors running outwards. In order to have the frame as small as possible in comparison with the surface, one should try to give the vineyard as near as possible the form of a square. In this case one requires less of the expensive and heavy standards. If I therefore want to plant 10,000 square yards (one morgen) with Almeria grapes, and trellis them according to this method, then I

should make the sides each 100 yards. The perimeter is then 400 yards. If I make the sides respectively 500 and 200 yards instead of the above, then I still have 10,000 square yards, but then the perimeter is 500 yards instead of 400 yards as in the previous case.

The inside standards (N, figure 13) need not be longer than 8 ft. 6 in. and weigh more than about 20 to 24 lb. If the soil is loose it is best to let the points of the standards rest on stones. All they need do is to support the weight of the trellis, there being no tension on them sideways. The standards are placed at 12 ft. square, with an additional one between every four standards, as may clearly be seen in figure 13. The wire is spanned through the top holes of the standards. For the main wires (AH, BG, CF, DM, EK) a fairly thick galvanized-iron wire should be taken (No. 15 or 16) whilst for the cross wires (BD, AE, MF, KG, EG, DH, CK, BM) a much thinner wire (No. 11 or 12) is required. These cross wires are given in the

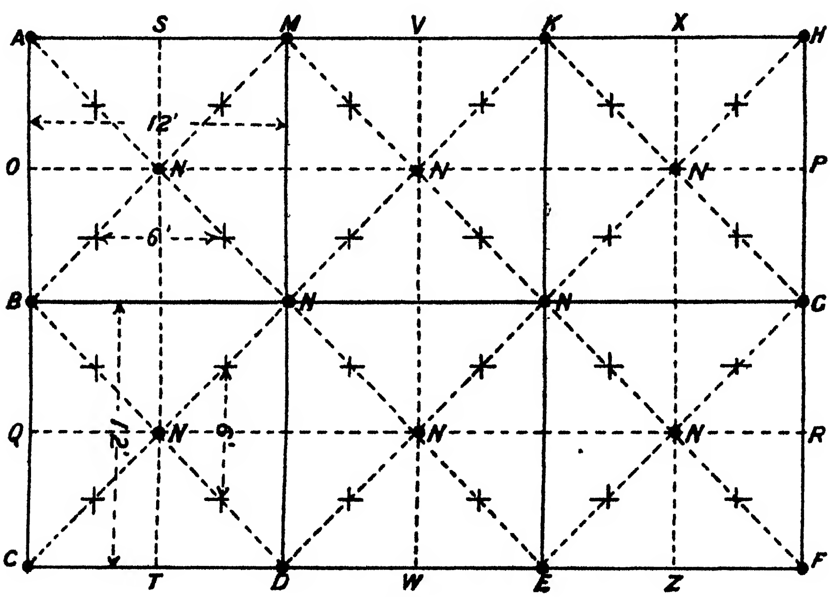


Fig. 13.

figure as dotted lines. The thick wires must be spanned tightly in order to support the whole wire net well. Besides the above-mentioned wires, also the following wires should be spanned: OP, QR, ST, VW, XZ (dotted lines, figure 13). For these wires the same kind of wire as for the cross wires, CK, DH, etc. (figure 13), should be taken.

Then AO is equal to OB = AS = SM = 6 ft. Now a fairly thin wire is twisted through the whole net at distances of 2 ft. in the direction of the sides AH and AC. Therefore, two such thin wires come between the points A and O, which are fastened between H and P. In the same way two wires run between O and B, which are fastened between P and G, two between A and S, which are fastened between C and T, etc. Now the net is complete. The vines are planted 6 ft. square, as the crosses in figure 13 indicate. In the first year the vines are given a spur with two eyes. At every vine a stake is placed

which is fastened to the net above. The young shoots are tied to these stakes. Once they have reached the net they are trellised on it. Next pruning season the vines are pruned in such a way as to leave them three to four eyes on the net. When sprouting, all shoots, excepting the three or four highest which are trellised on the net, are broken off. From now onward the shoots are distributed systematically over the net, and short and long bearers are pruned. The last-mentioned are given a length of 3 to 6 ft., till one finds that they bear enough. One has to prune very long bearers, as the Ohanez hardly bears anything if pruned short.

(To be continued.)

Rural Notes.

Cold Storage for Export Fruit.

In November Mr. F. B. Smith, Secretary for Agriculture, addressed the following letter to the Union-Castle Steamship Company, Ltd., at Capetown, on the subject of cold storage accommodation in mail steamers for fruit exported to England: "I am directed to express the regret of this Department on learning that the new refrigerating machinery necessary to increase the cold storage space in the mail steamers cannot be delivered in time for it to be fitted and in use during the forthcoming fruit season, and to state that it is feared that this will not only have a serious effect upon the export of fruit but will give rise to a great deal of dissatisfaction in respect of any shipments which may be unavoidably shut out. I am, therefore, to ask whether it will be possible for your Company, with a view to relieving the situation as much as possible, to arrange for the boats with the most cold storage accommodation to be available for this traffic during the period in which the heaviest shipments of fruit are usually made." The following communication in reply has now been received from Sir Owen Phillips: "Our Capetown agency duly forwarded to us a copy of your letter of the 9th November, and we assure you that it is more a matter of regret to us than to the Department of Agriculture and your good self that the new refrigerating machinery necessary for the extension of the cold storage capacities of our mail steamers cannot be made and installed in time for using the extended chambers during the coming season.

"We had already anticipated the possibility," Sir Owen proceeds, "of giving additional facilities with a view to relieving any pressure that might arise at the height of the season by arranging that our intermediate steamers should supplement the mail steamers to the extent of specially landing fruit at Southampton in the same way that mail steamers do, and we have given instructions accordingly for such arrangements to be borne in mind and carried out as circumstances may require. We are also carefully considering the sailings of our mail steamers homewards and shall endeavour to so arrange the departures that the mail steamers with the largest accommodation

may leave Capetown at the time when it is most required. We feel sure that you will appreciate that everything in our power will be done, with the supplementary arrangements of the intermediate steamers referred to, to minimize any inconvenience that you may apprehend through the unavoidable period involved in increasing the cold-chamber accommodation of the mail steamers."

More Lamziekte Correspondence.

In continuation of the correspondence published in the last issue, Mr. J. Burtt-Davy has received the following further letter from Mr. L. S. Meintjes:—"I do not hold that the lack of nitrates is the direct cause of gal-lamziekte, but that its deficiency in the animal's system causes the animal to assimilate more readily some nitrogenous substance containing poison found in wilted grass. What gives additional colour to this theory is that, whereas we had the previous season some dozen cases of stijfziekte, this season we had not a single case, in a season infinitely worse. It may be that cattle having access to sufficient nitrates will not eat "crotolaria." I have no reason or proof for this theory, but it has become so fixed in my mind that I give it for what it is worth. It has never been accounted for why gal-lamziekte in latter years has appeared where hitherto it was unknown. Why is it found in some parts and not in others where similar conditions prevail? Droughts we have often had, but never gal-lamziekte as in recent years. I am inclined to the belief that the cause will ultimately be found in some nitrogen-collecting bacteria which, in addition to nitrogen, collect also toxic substances in plants other than leguminosae, under the conditions which we attribute as the case of gal-lamziekte, and that these bacteria are gradually spreading over this country. The only other alternative is that (as some hold) since the war cattle have been bred from all sorts of weeds lacking in constitution and are not able to resist disease. This, however, on reflection is untenable, as here in Bechuanaland there are herds which were in no way affected by the war and to which no additions have been made from other parts, yet in these herds the disease is as bad as in any other. That constitution is a considerable factor I have ample proof, but constitution alone will not stop the disease under the conditions which prevailed here during the month of December. The 'bacteria' theory, I believe, will lead to the discovery of the cause of the disease."

Mr. J. J. Keeley, of Mosita, via Maribogo, also writes to Mr. Burtt-Davy:—"Yes, I found it very beneficial to keep cattle in the bults, and away from the black valleys and pans. The grass grown on the black soil in times of drought is poisonous to the cattle. I have a valley running through one of my farms, and in dry seasons I could not run cattle on the place. Now I have a troop of sheep running on this valley, and of course the sheep keep the veld too short for large stock, consequently I have few deaths there from lamziekte. I could mention many such instances these last ten years, i.e. keeping the cattle in the bults stopped lamziekte. My herd of cattle has now increased to the large number of two thousand. I have not sufficient space to dodge this disease so effectually." Mr. J. L. Combrink, of Concordia, P.O. Geluk, Vryburg, writing on the 3rd November to

Dr. Theiler, said:—"There are three cases of gal-lamziekte on green fodder. No. 1: A cow which was kept in stable, getting no grass to eat, but only fed on barley (the field being dry). No. 2: A cow fed on barley in the morning, and after that sent to a small camp; in the evening barley again (field also dry). No. 3: Three cows fed on lucerne half an hour in the morning and afternoon respectively. . . . These three cases did not happen on one farm, but on three different farms."

East London Cotton Station.

A report on work accomplished at the recently established Cotton Experiment Station at East London states that the cotton crop was planted during the first half of the month of November. It germinated, on the average, in about six days; the plants grew rapidly and were looking remarkably healthy until they had attained a height of about four inches, when the wind tore them about. A cold biting wind was experienced on the 24th November, and on the 25th it was observed that considerable damage had been done. Trouble has also been experienced with a swarm of grasshoppers, but these have been successfully coped with. The following particulars of the cotton planted are given:—

Variety.	Area. Acres.	Date Planted.
Nyasaland	2	4th November.
,, ...	5	5th ,,
Abassi	$4\frac{1}{4}$	6th ,,
,, ...	$3\frac{3}{4}$	7th ,,
Nyasaland	1	7th ,,
Caravonica (silk) ...	$\frac{7}{8}$	9th ,,
Sea Island	$2\frac{1}{2}$	11th ,,
Mitafifi...	$2\frac{1}{2}$	13th ,,

On the fertilized plot of ten acres the following varieties were planted:—

Variety.	Area. Acres.	Date Planted.
Christopher	2	15th November.
,, ...	$1\frac{1}{2}$	16th ,,
,, ...	$1\frac{1}{2}$	18th ,,
Nyasaland	1	18th ,,
,, ...	1	19th ,,
,, ...	1	22nd ,,
Abassi...	1	21st ,,
Sea Island	1	20th ,,

Four and a half acres of Christopher were also planted on unfertilized land on the 20th and 22nd November. An interesting note on agricultural conditions generally is also included in the report. Writing early in December, Mr. D. D. Brown, the officer in charge, says:—"Farmers in this district are, in many cases, completely without water for their cattle; the grazing near the coast is good. The rain which fell here on the 30th, and also on the 1st December, relieved the situation in which a good many farmers were placed. After the rain last Saturday there has been general activity among the farmers, and they are ploughing and sowing their fields whilst the ground is still in good tilth. The maize crop has suffered a good deal through

the weather being so dry and windy. Most of the mielie crop will be planted during the month of December, as it has been too dry to attempt planting with success before heavy rains have fallen."

The Drought and the Tobacco Crop.

South Africa is now recovering from perhaps one of the worst seasons in regard to drought that it has been her misfortune to experience in the history of farming in this country. Conditions are becoming normal once more, but the effects will be more lasting. Tales without number of losses in stock have reached the public through the medium of the daily Press, and the effects upon crops have been hardly less adverse. Little, however, has been said with regard to the effect of the abnormal conditions upon the tobacco crop in the Transvaal. Reporting at the beginning of December, the officer in charge of the Rustenburg Experiment Station (Mr. H. W. Taylor) said that throughout the district the conditions were critical. The light rains were not general, and in some parts there had been next to no rainfall. Several farmers were compelled to trek their cattle to the Elands River or Crocodile River in order to prevent their perishing from thirst. The supply of water for irrigation was daily becoming less. On two farms where there had never hitherto been a shortage of water the owners had been compelled to discontinue irrigating their lands and devote all of the water to keeping their tobacco seed beds alive. Men acquainted with tobacco conditions in the Rustenburg District were generally agreed that 50 per cent. of a crop could not reasonably be raised, even should the remainder of the season be favourable. Early in the season the prospects were good for a large acreage of cotton in the district. On account of the drought, however, farmers have not been able to prepare their soil, so that there will be very little cotton grown in the Rustenburg District this season. Mr. W. B. Wilson, in charge of the Barberton Experiment Station, reported about the same time:—"As yet we have had no favourable weather for the transplanting of tobacco. It has been very hot and dry, and with the continual hot sun it has been difficult to get plants to live even where we have irrigation. On the 15th there was a fall of rain measuring .85 inch. This made ploughing possible for a short time, but the ground soon became very dry again."

From the Tzaneen Estate comes the report (also penned about the beginning of December) that owing to the continued drought the planting outlook for this season is very gloomy indeed. Week after week heavy clouds would appear, which were dispersed again by winds. The officer in charge of the Piet Retief Station (Mr. R. T. Falgate) tells the same story. Reporting for November, Mr. T. E. Elgin, in charge of the Government Tobacco Warehouse at Rustenburg, writes:—"There have been a few very light showers of rain during the month, the best rain coming on the 15th, but the total rainfall has not been sufficient to have much effect on vegetation. There is very little grass for stock, and the cattle are in a very poor condition. Should rain come now some farmers could not do much ploughing until their oxen put on some flesh, as at present the animals are in no condition for work; consequently it will be very late before

the lands can be prepared for crops. There still seems to be a good supply of tobacco plants, although many became overgrown and were lost. More seed has been sown, and will perhaps make plants in time to be used late in the season. Farmers who have water for irrigating have been transplanting as their plants were ready. It is unfortunate that many farmers do not prepare for a drought by ploughing their lands in summer before the rains stop, so that what little rain did fall would be absorbed by the land instead of running off and being lost." With regard to the prospects of the tobacco crop, Mr. Elgin writes:—"At present the indications are that there will be only a very small tobacco crop planted in the Rustenburg District. Some think, however, that if rains should be plentiful and well distributed from now to the end of the growing season there would be at least two-thirds as much tobacco this year as was grown in 1911-12. Others think it almost impossible to have more than half a crop this season."

The Cape Tobacco Industry.

Tobacco growers will be interested to learn that a co-operative society has been established for the purpose of dealing with the produce of the Western Province tobacco growers. The society has been established as a limited liability company, and the necessary capital has been subscribed by the growers. The object of the company is to grade, mature, and sell the tobacco grown by its members, and for this purpose a building has been secured at Paarl. The company is representative of most of the growers, and there are only a few small planters unconnected with it. One of the principal functions of the company will be to sell to manufacturers, who will in future be asked to buy at the Paarl store. The present development is the outcome of the Capetown tobacco sales which have been held in the past under the auspices of the Chamber of Commerce. These sales were initiated three years ago with two principal objects, namely: (1) To encourage and enlarge the output of tobacco in surrounding districts, and (2) to obtain through the medium of auction sales fair prices for the growers. The objects of the Chamber of Commerce have now been achieved. The area under cultivation is 600 acres, or 150 acres more than last year; and the output is also advancing: this year it is estimated to reach 250,000 lb. (it would have been 300,000 lb. but for adverse weather conditions). The auction sales have done much to help forward the industry, and whatever weaknesses the system exhibited are expected to disappear under the new scheme. Western Province tobacco growers are to be congratulated upon their enterprise, which is a big step in the right direction. Nor must the encouraging assistance rendered to the growers by the Capetown Chamber of Commerce be lost sight of, as the formation of the new association is primarily due to the efforts of this body.

Stock from the Netherlands.

The Department of Agriculture notifies that, in the issue of permits, under section *four*, sub-section (2), of Act No. 14 of 1911, for the introduction into the Union of cattle, sheep, pigs, and goats from the Kingdom of the Netherlands, the Principal Veterinary Officer will be guided by the following conditions, and no such permits in

respect of cattle, sheep, pigs, and goats from that Kingdom will be issued unless and until such conditions have been complied with in every respect. We are asked to add that, in view of the outbreak of foot-and-mouth disease in Friesland and South Holland, permits will not be issued for the importation of stock from those provinces into the Union until they are officially declared to be free from the disease. The following are the conditions referred to above: (1) For the purpose of these conditions the term "stock" shall be held to mean cattle, sheep, pigs, and goats. (2) The permit will only be issued for the introduction of stock into the Union through the ports of Capetown and Durban. The permit will be issued subject to the following conditions: (*a*) The stock on arrival at the port shall be subjected to an inspection by a Government veterinary surgeon and if passed as healthy by that officer shall be landed and removed to quarantine sheds and therein quarantined for a period of fifteen days. (*b*) All stock so landed are accompanied by a certificate in the subjoined form A, and that if any appearance of foot-and-mouth disease (*Epizootic aphtha*) be discovered by the veterinary inspector amongst the live stock on board any vessel on her arrival the permit will be withdrawn. (*c*) No litter, manure, or hay of any kind belonging to the importer or utilized by him on the voyage for the stock shall be landed from the vessel which conveyed the stock. (*d*) All expenses of feeding, inspection, testing, destruction, and otherwise of the stock shall be borne by the importer or his agent.

Certificate "A" is as follows: I do hereby certify that the undermentioned stock is free from disease and has come from a province which is free from *Epizootic aphtha* (foot-and-mouth disease).
Number and general description of stock....................................
Place from which stock has come...
Name of consignee..

....Signature.
....Title.
....Place.

Date..

(To be signed and issued immediately before embarkation by a duly qualified veterinary surgeon, and to be countersigned by a responsible officer of the State Department of Agriculture of the Netherlands.)

Sheep from Australia.

Mr. McNab, Government Sheep and Wool Expert, has submitted the following report on the purchase of sheep by him during his recent visit to Australia:—"I have to report having purchased 930 sheep on my visit to Australia. Of these, 265 were for Grootfontein School of Agriculture, comprising two Wanganella rams and 160 Wanganella ewes, two Murray rams and 101 Murray ewes. One ram I also purchased for Grootvlei Experimental Farm, Orange Free State, a Wanganella. I purchased the Murray sheep from Mr. Alick Murray and from Messrs. Murray Bros. The Wanganella came from the stud of Albert Austin, Wanganella, executors late L. I. Body, Bundemar,

and from A. J. and H. L. Austins, Murgha, all New South Wales breeders. The balance of the sheep I bought were for private owners in the Orange Free State, Transvaal, and Cape Provinces. I also assisted Messrs. Meyer, Spies, Butler, and Collett in the purchase of sheep and their shipment. I reached Australia in one of the greatest droughts known there, hence stud sheep were not in good condition, but this rather assisted me in purchasing high-priced sheep than otherwise, as owners were prepared to sell to relieve over-stocking. Cheaper class ewes were not so easily purchased, as flocks had been already considerably decimated with the drought and owners wished to hold remaining animals. Freight for animals I found difficult to procure at reasonable rates, in most cases 30s. per head being asked. However, I managed to arrange freights at 25s. by White Star Lines and Wm. Crosby & Co. Lines. Insurance rates were 5 per cent., less 2 per cent. rebate if no claim were made, though usual rates in Australia are 4 per cent., no rebate. Prior to my leaving Australia they had good rains and the country looked well." Further particulars regarding the purchase of pure-bred stock by Government will appear in our next issue.

Sheep-shearing Demonstration.

On the 14th December a sheep-shearing competition was held under the auspices of the Leeuwdoorns Farmers' Association at Leeuwdoorns. There were eleven competitors, and the event was closely contested. A maximum of 25 points was possible—time 5, opening-up 5, laying out of the fleece and keeping it unbroken 5, clean work and no second cuts 10. The leading four ranged from 19¼ to 18¼ points, with a tie for the first place between G. Reeders and G. F. de Necker. The tie was afterwards decided, when the competitors took 12.30 and 14.55 minutes respectively on their task. The prize-winners were:—1st, G. Reeders, 19¼ points; 2nd, G. F. de Necker, 19 points; 3rd, J. van der Linde, 18½ points; 4th, A. G. Roodt, 18¼ points. The tie having been decided, the first prize-winner was asked to shear another sheep, Mr. Mallinson, the Principal Sheep and Wool Expert (who judged on the occasion) demonstrating how the work should be done. A petrol-driven two-shear plant was on the spot, belonging to Mr. Z. Haasbroek, for demonstration purposes. The animal shorn by the winner was reshorn with this plant, and an additional pound of wool was obtained. A second competition then took place in skirting and rolling. There were eight competitors, and the scale of marks was as follows:—Picking up the fleece, 5 points; throwing on table, 5 points; skirting, 10 points; rolling, 5 points. The awards were—1st, S. J. Hyde, 20 points; 2nd, P. de Necker, 16 points; 3rd, W. R. Robinson, 15 points; 4th, Z. Haasbroek, 14 points.

Lecture on Sheep and Wool.

Mr. Mallinson then gave a demonstration in skirting and rolling, explaining that the object in skirting is to leave the fleece as even as possible. At the close of the competitions a lecture on sheep and wool was delivered by Mr. Mallinson, whose remarks were translated into Dutch by Mr. A. M. Spies, the newly appointed Assistant Sheep and Wool Expert for the Western Transvaal, to a meeting of some fifty

farmers. Mr. Mallinson spoke of the need for a proper water supply and the fencing-off of paddocks. Sheep should be given water such as human beings could use. They should not be kept constantly grazing on one area; they needed change if they were to do well and to avoid disease. The need for classing sheep and the selection of the best animals as breeders was next pointed out. Shearing and the preparation of wool for the market were dealt with at length, and after many questions had been answered by Mr. Mallinson the proceedings terminated with a vote of thanks to Messrs. Mallinson and Spies. Demonstrations and competitions such as these are of great practical value to farmers, and it would be well if more farmers' associations would follow the excellent example of the progressive Leeuwdoorns Association.

Cyrtanthus dendrophilus: J. M. Wood MSS.

Mr. J. Medley Wood, the Director of the Natal Botanic Gardens, Durban, sends the following note:—The genus *Cyrtanthus* is exclusively African, and, according to the *Flora Capensis*, includes twenty-five species, of which twenty-four are South and one tropical African; one only of the South African species, *C. sanguineus*, is also found in tropical Africa. The flowers of all the species are either white or various shades of red, but in one species, *C. lutescens*, yellowish. They are with one exception borne with umbels, but in *C. Galpinii*, a small species, they are solitary. All the species are tuberous; and while some, such as *C. McKenii* and a few others, are usually found in moist places, *C. angustifolia* and some others are found on the hills amongst grass and fully exposed to sunlight. My nephew, Mr. W. J. Haygarth, who has at different times collected and contributed large numbers of specimens to the Colonial Herbarium, many of which are rare and some new to science, being away for a short holiday found a species of *Cyrtanthus* which seemed to be new to him, and sent to me a couple of specimens. I found that the plant was certainly an undescribed one, and could not be placed in any of the sections into which the genus is divided, but the feature which is the most interesting is that the plants grow, not in the ground, but amongst masses of moss on the trunks and branches of large trees of yellow-wood (*Podocarpus* sp.), some of the branches at 50 or 60 feet from the ground being covered on their upper sides for several feet with the moss, amongst which this species of *Cyrtanthus* seems to find its subsistence. The roots proceeding from the bulb are numerous, slender, and whitish, rambling amongst the moss, but seldom—if ever—touching the bark of the tree, and certainly deriving no nourishment from it. Mr. Haygarth informs me that he searched for any of the plants which might be growing on the ground, but found none. A few of the masses of moss which had been detached from the trees by wind or other causes had these bulbs amongst them, but their roots had not taken hold of the ground. In another locality in the vicinity he found a few of the *Cyrtanthus* growing in crevices of rocks, but again in company with the moss. The flowers are scarlet with a faint tinge of orange, and the plant will, I think, be a great acquisition to horticulturists, especially for hanging baskets. I have described it under the above name, and the description has been sent to Kew for publication in the *Bulletin*. Dried specimens were also sent, together

with bulbs for cultivation, and a few bulbs have been sent to the Royal Horticultural Society for trial in their gardens, where it is hoped they will grow and flourish.

Trees of Interest at Durban.

Mr. J. Medley Wood, in another communication, writes: There is now in flower in the Botanic Gardens, Durban, a tree named *Hura crepitans*, but more popularly known as the "sandbod tree," or the "monkeys' dinner bell." This tree is a native of the West Indies and tropical America, and belongs to the order *Euphorbiaceae*. The *Guide* to the Gardens, published in 1897, says of it: "It is a tree reaching to 30 or 40 feet in height, and is sometimes planted as a shade tree. The fruit is the size of a small orange, and when ripe and dry explodes with a report like that of a pistol, in consequence of which peculiarity it has been called the 'monkeys' dinner bell.' The juice of the tree is very poisonous, and if it enters the eye it is said to cause immediate blindness. The seeds are emetic and purgative, and the wood is soft and brittle. Before the use of blotting paper became universal, the seed vessels were used to contain sand, or pounce, but it was necessary first to bind the capsule with iron or wire to prevent explosion in dry weather." Our tree was planted in 1890, and is now bearing flowers for the first time. Another writer says of it: "Its fruit is of the size of a large apple, very much flattened, and formed of twelve to fifteen cells like the segments of an orange set round a common axis, and in each is contained a large flat seed. . . . The fruit was used as a sand or pounce box, but it was necessary to bind them with a hoop of iron, otherwise the power of elasticity of which they are possessed is so great that even at the end of some years they fly to pieces with a loud report like fire-arms, and hence the origin of the specific name."

Another notable small tree (Mr. Wood continues) bore flowers in the Gardens last summer and has again done so this season, but no fruit has been formed. The tree is a species of *Lecythis*, and belongs to the order *Myrtaceae*. When this tree was introduced into the Colony must remain doubtful; the only information that I can obtain is that, in 1873, a species of *Lecythis* was imported, but nothing more was heard of it, and as no species of the genus has been imported since 1882, this is probably the one referred to. The trees of this genus are natives of tropical America and are popularly known as "monkey pot" or "cannon ball" trees, and one or more of the species produce the nuts commonly known as "sapucaia nuts," frequently met with in the shops of fruiterers in the Homeland. The trees are usually tall, and a writer says: "The fruit is very hard, as large as a child's head, and furnished with a lid which falls off when it is ripe, and the dry pulp and seeds also fall out, but the pod or capsule frequently hangs on for two years afterwards. Each of these capsules contains a number of nuts, which are about an inch and a half or two inches long, slightly curved, and grooved, being in shape like a small gherkin cucumber, but of a light brown colour. The shell is soft and the kernel is very mild, mellow, with a sort of cream or custard flavour, and may be eaten either raw or roasted." It is much to be regretted that so far neither of these trees shows any sign

of setting fruit, and it will be interesting to know whether trees of either of the species exist in any other part of the Union, and, if so, whether they have flowered or borne fruit?

A Self-discharging Truck.

We have received from Messrs. F. Cook Company, Ltd., of Greenmarket Square, Capetown, particulars of a new self-discharging railway truck invented and patented by them, designed for the expeditious handling of coal and grain. The interior fitting of this truck, together with the arrangements for self-discharge, are easily applied to practically every class of truck. When loaded, a truck so fitted conveys very nearly the full complement that it was originally intended to carry, as very little of the interior space is occupied by the inclined planes, while the weight of the contents is equally divided on either side, and cannot overbalance the vehicle. Whereever grain is received in bulk in the self-discharging trucks—at railway or port depots—a number of attachments in the form of bent metal mouthpieces with short canvas hose attached are kept ready for use. These attachments are interchangeable and are fastened to the openings in the truck bodies, and on lifting the door the grain naturally flows out through the tube into a bag or other receptacle which is placed on a scale underneath the opening. By working the lever the flow of grain is regulated at will and immediately the required weight is within the bag the latter is removed and sewn up for export or local delivery. In this way the whole of the contents of the truck to the last grain can be emptied by this process as fast as it can be filled into bags at four or more openings in each truck. The principle of the invention is simple. The truck is fitted with inclined planes, rising from the sides of the floor and meeting above, and with four sliding doors to permit the contents of the truck to be run off into sacks. These inclined planes ensure a continual flow, whether the contents be coal or grain, until the truck is empty. The saving in time, as well as in labour, is considerable, enabling the work of offloading to be carried out with a dispatch that is unobtainable by the ordinary methods.

Aloe Americana.

The Government Agrostologist and Botanist (Mr. Jos. Burtt-Davy) has received the following letter from a correspondent in the Bethany District, Orange Free State:—"In reply to your request *re* bulbil-bearing flower stalks of the American aloe or Garen-boom, in the last issue of the *Journal*, I might mention that I have often seen stalks carrying both flowers and bulbils. I am sorry to say that I did not, at the time when the flower stalks bore also bulbils, take any notice of these young plants, which appeared when the buds of the flower stalks opened or after a while; I cannot even say what would have become of them—if they would fall off after a time—as I cut down the stalks to make a shearing kraal. This year again, on account of the drought most probably, only three flower stalks appeared in a hedge more than 300 yards long and these were broken by a strong wind before the flowers opened. Should I come across some of these bulbils I shall forward them to you. . . . The bulbils are very similar to the little aloe plants growing around the big

ones." Mr. Burtt-Davy states that the evidence so far received points to the bulbil-bearing plant being a distinct species from the common Garen-boom (*Aloe americana*). It is desirable to have specimens for identification. These should consist of the end spine from a leaf and a piece of the leaf margin, about nine inches long, to show the shape and colour of the marginal spines. Mr. Burtt-Davy's correspondent, in the same letter, remarks that the leaves of the aloe cut in small pieces are excellent food for cattle in times of drought. "The veld was so bad here that sheep began to die of hunger, yet I did not lose one head of cattle, keeping them alive on aloe only. In case cattle do not want to take to the cut-up leaves," correspondent adds, "moisten salt and sprinkle over the pieces, after which they will soon tackle it."

A White Leghorn Year Book.

We have received from the Secretary of the South African Utility White Leghorn Club (Mr. K. B. Jobling, P.O. Box 177, Capetown) a copy of the 1912 *Year Book* which has recently been issued by the Club. The book is well got up and contains some useful articles. Mr. Arthur Little, the Poultry Expert of the Grootfontein School of Agriculture, Middelburg, Cape Province, contributes a paper on the economical feeding of eggs; Mr. Ralph G. Hudson writes on judging; Mr. S. Smith discusses the origin of the South African Utility White Leghorn, and there is also a paper on the origin of the South Australian variety of the breed. Among reprinted papers by Australian authorities, particular mention must be made of those dealing with the subject of "egg-circles." South Africa knows little or nothing in a practical way yet of "egg-circles," but those interested in the development of the poultry industry in this country recognize the important part which the "egg-circle" system would play if it could once be established here. The "egg-circle" system is really a series of co-operative societies, each comprising not less than fifteen members, all of whom guarantee to deliver eggs to the secretary not less than once a week in winter and not less than twice a week in summer. The secretary forwards these eggs to the society's town depot or the Government Produce Depot. Obviously a number of circles may make use of the same town depot and so secure greater advantages than they would if each circle worked independently. One of the great troubles with our poultry industry is the lack of organization for the collection and marketing of eggs. Each individual works for himself, whereas co-operation would secure great advantages for every one concerned. The South African Utility White Leghorn Club is to be congratulated upon its enterprise in issuing a *Year Book* that cannot fail to be of interest and value to persons engaged in poultry raising. Copies are on sale at the principal railway bookstalls throughout the Union, and can also be obtained from the Secretary of the Club. The price is one shilling.

"Wire-worms in Sheep."

At the conclusion of his article on "Wire-worms in Sheep and their Treatment," in the October, 1912, issue of the *Journal*, Dr. Theiler stated that it was the intention of the Veterinary Research

Division to continue the investigations into wire-worms under all possible conditions, and invited information regarding any remedies used with success by farmers. On receipt of these particulars, Dr. Theiler added, the Division would undertake the tests in the same systematic manner in order to ascertain if better methods could be adopted to remove wire-worms in sheep. Some of the letters which have been received with reference to this note suggest that the writers have misunderstood what Dr. Theiler intended. Dr. Theiler asks for information *re* bona fide farmers' remedies for wire-worm, but he cannot undertake the extensive testing of and report on proprietary worm remedies, as has been suggested.

Miscellaneous Notes.

We are asked by the Senior Veterinary Surgeon, Natal, to state that the name of Mr. H. E. Symons, of Riverlea, Underberg Division, was omitted from the list of dipping tank owners which appeared in the September issue of the *Journal.*

Early advantage is being taken of the special terms for the carrying of pedigree stock freight free under the new mail contract, as is evidenced by the last shipment arriving in January per s.s. "Cawdor Castle," which carried sixteen mares, one thoroughbred stallion, and one Hackney stallion.

Messrs. Wm. Cooper & Nephews, the well-known manufacturers of dipping materials, have sent us copies of their "Sheepman's Diary" and "Sheep, Goat, and Cattle Farmers' Notebook" for 1913. Stock farmers will find many useful notes in these little books, copies of which may be obtained gratis from Messrs. Cooper & Nephews, Terminus Street, East London.

Cabling on the 15th January, *Reuter* stated that the best of the peaches arriving from South Africa per the "Armadale Castle" realized 62s. 6d. per box of twenty-four at Covent Garden, while boxes of twenty-eight fetched 50s. to 56s. Only 700 boxes of Cape fruit were placed on the market, compared with 6168 in the corresponding period of last year.

Mr. George Campbell, Bieldside, Aberdeen, the well-known live stock exporter, recently sent a consignment of fine Shorthorns to the Argentine, for which record prices have been obtained. For eight bulls he had an average of £972. 13s. 6d., and for eleven cows and heifers the average was £229. 9s. 10d. One fine bull, Sunbeam's Pride, realized the huge sum of £3144. Another, Scottish Crest, sold for £1746. 14s. 1d.; while a third, Westside Golden Waterloo, brought £917. The top price among the cows and heifers was £672. 9s. 4d.

The Cotton Ginning Plant.—The news, published during January, that the British Cotton Growing Association have handed over to the Union Government, as a free gift, the very valuable cotton ginning plant which the association a year or two ago sent on loan to Messrs. Nathanson Commandite, of Durban, will be welcomed by cotton planters in all parts of the Union. The plant in question is by far the most complete and up-to-date of any in South Africa, and this generous gift represents a cash value of some £2000. It is handed over to the Government free of any expense as from 1st January to be used in the likely centres for cotton ginning, from time to time, as the industry develops.

Sheep Classes at Johannesburg Show.—Our attention has been drawn to a notable departure which has been decided upon by the committee of the forthcoming Witwatersrand Show in connection with the sheep section. In the prize list will be found new classes for rams under offer at 50 and 25 guineas respectively. The idea is to enable the smaller men to show their sheep, which could not be expected to compete against animals valued at hundreds of guineas. The innovation will doubtless be widely welcomed, and it will be interesting to note, when the show takes place, what measure of support has been offered and the keenness of the resulting competition.

Confused Telegraphic Addresses.—Some confusion and much delay from time to time has been caused by persons desirous of wiring to the Transvaal Agricultural Union using the telegraphic address of the Secretary for Agriculture and vice versa. Not only is the time of the respective officials unnecessarily taken up as a consequence of oversights such as these, but the interests of the persons themselves who have dispatched the messages necessarily suffer through the delays which must ensue. We have accordingly been asked to call the attention of the public to the fact that the registered telegraphic address of the Secretary for Agriculture and the Transvaal Agricultural Union respectively are quite distinct. Correspondents should bear in mind that the telegraphic address of the office of the Secretary for Agriculture, both at Pretoria and at Capetown, is "*Landbouw*"; whilst the address of the Transvaal Agricultural Union is "*Agricola, Pretoria.*"

Staff Movements and Changes.

A temporary staff has been appointed at Capetown for the fruit export season to administer the fruit regulations. Mr. R. J. Bulmer, the Government Fruit Inspector, is in charge.

During January Mr. R. A. Davis, Government Horticulturist, visited Capetown to inspect the working of the new fruit export regulations, and then toured the Montague District and the Long Kloof, and finally the pineapple districts of Albany.

Mr. J. T. Taylor, of the Co-operative Division, has been transferred to the Land Bank.

Mr. R. G. Hodson has been appointed Assistant Accountant to the Department.

Schools and Experiment Stations.

A considerable number of appointments have recently been made on the staffs of the Agricultural Schools for the purpose of carrying out the educational, research, and experimental work at those institutions.

Elsenburg.—Dr. A. I. Perold, Government Viticulturist of the Cape Province, succeeds Mr. W. Allen as Principal of the Agricultural School, Elsenburg, and with this office will be combined his previous duties connected with the office of Government Viticulturist, Cape Province. Dr. Perold has had an extensive training in agricultural science, both in South Africa and in Europe, and it will be remembered that a few years ago he was sent by the Cape Government to Southern Europe for the purpose of specially studying the methods and practice of viticulture. Mr. Wagner, the Assistant

Viticulturist, has been transferred from the Oenological Station, Paarl, to assist Dr. Perold in connection with his work at Elsenburg. A Lecturer in Botany and Plant Breeding has been appointed in the person of Mr. J. A. Neethling, B.S.A., a graduate of Cornell University, U.S.A. In addition to his educational work, Mr. Neethling has already started research and experimental work in connection with the improvement of the cereal crops of the Western Province, through the principles of plant breeding. Mr. H. O. S. Reinecke, B.S.A., a graduate of the Guelph Agricultural College, Canada, has been appointed Assistant to the Horticulturist and Viticulturist. Mr. Reinecke took a special course of study in horticulture at Guelph, and subsequently travelled in California with a view to acquiring a knowledge of the methods and practice obtaining there. Mr. W. O. John, Manager of the Columbia Poultry Farm, Kimberley, has been appointed to the post of Lecturer and Instructor in Poultry Keeping. Mr. John has had a wide and extensive experience in poultry breeding and management, and should be of considerable assistance in furthering the poultry industry of the Western Province.

Grootfontein.—Mr. G. J. Bosman, B.S.A., a graduate of the Iowa State College, Ames, U.S.A., succeeds Mr. E. Harrison (transferred to the principalship at Cedara) as Lecturer in Agriculture and Stock. The appointment of Mr. C. Morris as Lecturer in Agricultural Engineering has been confirmed.

Cedara.—In connection with the appointment of Mr. E. Harrison to the post of Principal of the School of Agriculture at Cedara, which was mentioned in our last issue, it may be observed that Mr. Harrison has had a distinguished and comprehensive training in agriculture and agricultural science. He graduated as Bachelor of Science in the Edinburgh University, holds the National Diplomas of Great Britain and Ireland for agriculture and dairying. Subsequently he took a post-graduate course in animal husbandry at the Iowa State College, Ames, U.S.A., and graduated Master of the Science of Agriculture at that institution. Steps are being taken to increase the staff and fully equip and well establish the School of Agriculture and the Experiment Farm at Cedara.

Potchefstroom.—In succession to Mr. A. Holm, who was promoted to the post of Under-Secretary for Agriculture, Mr. E. J. Macmillan, who was previously Assistant Director of Agriculture under the Orange Free State Government, has been appointed to the post of Principal of the School of Agriculture and Experiment Farm, Potchefstroom. Mr. Macmillan is a graduate of the Guelph Agriculture College, Canada, and brings to his new duties the experience obtained in eight years' work in South Africa. Mr. A. M. Bosman, also a graduate of the Guelph Agricultural College, has been appointed an additional Lecturer in Agriculture at this institution. He will also carry out extension and experiment work. To post of Farm Manager rendered vacant by the resignation of Mr. D. A. Wilson, who has been appointed Farm Manager to Sir George Farrar, Mr. Alex. Reid has been appointed. Mr. Reid was at one time Farm Manager at the Cedara Experiment Farm, and was lately Manager of the Roodepoort Stud Farm under the late Land Settlement Board of the Orange Free State. To the post of Lecturer in Veterinary Science Mr. J. R. R. Quinlan, who graduated M.R.C.V.S. at the

Dublin Veterinary College, has been appointed. Mr. Quinlan has had a distinguished career as a student, and among other honours won the Fitzwygram Prize as the best veterinary student of his year.

Mr. E. J. van Meerten, who graduated in agricultural engineering at the Iowa State College, Ames, has received a temporary appointment as an agricultural engineer in the Department, and will probably be at a later date attached to one of the agricultural schools.

The appointment of Messrs. Neethling, G. J. Bosman, A. M. Bosman, H. O. S. Reinecke, and E. J. van Meerten to these several posts in the Department is the outcome of the policy adopted by the late Transvaal Government in sending students abroad with scholarships for studying in agricultural science. These men are the first to return from their studies, and the Department welcomes their appointment to the technical staff.

Correspondence.

This section will be set aside for correspondence on all subjects affecting the Farming Industries of the Union of South Africa and cognate matters; and, while every reasonable latitude will be allowed, contributors are requested to be as concise and succinct as possible in the expression of their views.

Suggestions for practical consideration and discussion, and hints as to improved methods applicable to any branch of agriculture will be particularly welcome.

It must at all time be distinctly understood that the Department of Agriculture is in no sense responsible for the views and opinions expressed in this section.

All communications should be clearly addressed "The Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria," and written on one side of the paper only.

CLOSER SETTLEMENT AND SMALL HOLDINGS.

To the Editor of the *Agricultural Journal*.

SIR,—With reference to your interesting notes on above subjects in your issue of October, Vol. IV, where you state that "the curse of South Africa is the big farm," I presume you refer to purely agricultural farming and that the important branch of sheep farming is not considered. Under this impression permit me some space to briefly discuss the matter of closer settlement as affecting the permanent agricultural progress of this district. I desire to refer particularly to the grain-producing area known as the Ruggens (owing to its hilly nature). The soils are chiefly of a gravelly clay nature overlying, at an average depth of about 18 inches or more, a clay slate formation. The natural grazing is chiefly composed of the "Bokbaards" (*Andropogon*) and "Rooigras" (*Themeda forskalii*) growing amongst the Rhenosterbush. Where the veld is lightly stocked, or grazed under long periods of rest, and seldom burnt, it has been observed that the Rhenosterbush and Bokbaards degenerate and the valuable Rooigras gets an apparent upperhand. As you are aware, these parts are included in the south-west corner, which has a reputation for good wool, the highest price obtained this season for grease wool at the local Caledon sales being 11¼d. per lb. The area has proved to be as suitable also for horse and mule breeding.

Closer settlement is taking place here without State intervention. Owing to the high market value of farms during the last few years, many of the larger farms have been cut up into areas of, say, 400 to 700 morgen, and sold at abnormal prices. As it is not financially possible to economically graze such high-priced land, purchasers have ploughed up as much of their available virgin land as possible for grain-growing purposes, in order to obtain

the quickest and highest return on capital outlay. The total area under grain crops has, therefore, increased considerably within the last few years. This may appear like sound agricultural progress to those unacquainted with local conditions of soil and climate and with the systems of farming practised, but I will endeavour to briefly indicate that the system of grain growing in vogue, at present hardly avoidable on the small farm (too small and expensive for economical stock farming), means soil impoverishment and exhaustion. The arrival of this regrettable stage is already being experienced on many of the older lands, where payable yields are hardly possible under methods in vogue, and I fear the general realization of this threatening danger is only being delayed by the existence of available virgin soils, limited, of course, on the small farms.

On the small farm the production of farmyard manure is of course very much less than on the larger farms, where stock raising is carried on in conjunction with grain growing, and, even under careful management and preservation, is not likely to supply an eighth of the ordinary requirements in any one season. The most practical and speedy method of turning the surplus straw into suitable manure is one of the economic problems awaiting solution on the purely agricultural small farm, and in order to make room for the next grain stack and to avoid danger of fire the remaining straw is burnt on the approach of the harvesting season. The liberal application of farmyard manure to any of our grain lands need therefore not be considered here, owing to its insufficiency. Where it is practically possible to frequently and liberally apply well-kept farm manure to even a small portion of land, the danger of soil exhaustion is reduced to a minimum, but, unfortunately, small farms are entirely dependent of artificial fertilizers.

The fertilizer most generally used is superphosphates, which supplies (to an extent) only one of the plant-food ingredients removed by the crop, and, besides thus causing soil exhaustion, renders it less favourable to plant growth owing to its acid nature where continually applied in the absence of lime. The value of Government guano as a complete fertilizer is gradually becoming better appreciated, but, unfortunately, the available supply appears to be insufficient for the increasing demands of the Union. Even if this valuable fertilizer were available for general and liberal application to our grain soils the want of humus will be felt under continuous cropping. It will then, however, extend the realization of the evil day of general soil exhaustion, which is now being more rapidly accomplished by the continuous use of acid superphosphates on our lime-deficient soils. Artificial fertilizers containing nitrogen, phosphoric acid, and potash are beyond the reach of the poor farmer for general application.

Where sufficient virgin land is available purchasers of expensive small farms may succeed in clearing their property of all debt before all the lands reach the unprofitable stage under the manurial methods above described, but what is to become of their children? How are they to afford to bring back exhausted lands into a profit-yielding state? Are we not by the above system of cropping on small holdings adding to the existing poor white problem? Surely this state of affairs is of sufficient economic importance not only to this district, but to South Africa as a whole, to warrant the urgent attention of the Union Agricultural Department with a view to the general adoption of sounder and less destructive cultural methods. It may then be found that farms, especially the cut-up ones, have been sold above their economic value and that grain growing should be carried on in conjunction with stock raising.—Yours, etc.,

J. J. DE VILLIERS.

Dunghye Park, Caledon, C.P.

[Some of our readers may like to reply to the above thoughtful and instructive letter. For our part we would recommend our correspondent to read "Fields, Factories, and Workshops," by Prince Kropotkin, the greatest of agricultural economists. In that work he will see that Prince Kropotkin believes it possible for one square mile (640 acres) to support comfortably a thousand individuals under modern scientific cultivation. Rest and sunshine, deep tilling, farmyard and green manures, crop rotation, and the encouragement of nitrogen-gathering soil bacteria are the chief factors in the restoration of worn-out lands. The small holder of the future will not harm his little farm. Year after year he will increase its output by working the deeper soil levels. The heaviest acre yields are in the most densely populated and most intensively cultivated countries, where the farmer has no time to talk of soil exhaustion.—EDITOR, *Agr. Jnl.*]

WIRE-WORMS IN SHEEP.

To the Editor of the *Agricultural Journal.*

SIR,—I read with much interest Dr. Theiler's article in the *Agricultural Journal* for October entitled "Wire-Worms in Sheep and their Treatment," as in the Wodehouse District this plague is prevalent in rainy years. I say "in rainy years," and it is upon this point that I would be glad to have further light.

Experienced farmers who are familiar with this disease assert that the wire-worm enters the sheep through the agency of putrid water; that one can find these wire-worms in great numbers in such water, without even the aid of a magnifying glass; and that on farms where there are pans and many hollows one can also find wire-worms when, in rainless winters, the water becomes stagnant and the eggs of the wire-worm hatch out. I do not mean that the eggs only hatch out in putrescent water, but that, when the water becomes low, animals can absorb them more easily. Further, I mean that the wire-worms increase more rapidly in putrid water, as they have more nourishment.

How long these eggs remain alive in dry pans I do not know—it may be even as long as the scab insect lives in manure.

Dr. Theiler says that the female worm lays eggs which leave the body of the sheep with the excrement, and thus are spread over the veld, where they can readily hatch out and creep into the grass stalks, from which they are taken in by the sheep. How is it, then, that sheep in chewing do not destroy these worms, since a sheep ruminates?

Can the wire-worm live in the dry veld and also in water?

According to Dr. Theiler's tables the sheep under treatment were healthy, as well as without the administration of Cooper's dip and bluestone. This I consider to be precisely a proof that the sheep absorb wire-worms in putrescent water, for the sheep under treatment naturally had good water which contained no wire-worms, and the mature wire-worms that were in the sheep died out.

On farms where sheep drink running water only one seldom finds wire-worm.

Dr. Theiler say that if ruminating animals be kept off a farm for a year that farm will then be clear of wire-worm; but it has happened here on several farms that sheep have for two or three years been free of wire-worm, and that then, after much rain, the worms were found in great numbers in those sheep, and this happened just on those farms which had pans and hollows of putrid water.

It is difficult to know whom to believe—one or two learned doctors or a dozen experienced farmers.—Yours, etc.,

CHRIS. D. BOTHA.

P.O. Birds River Siding,
Dist. Wodehouse, C.P.

[The Acting Director of Veterinary Research (Dr. Wm. Robertson), to whom the above letter was referred, writes:—Mr. Botha is quite correct in his assumption that sheep can be infected in the neighbourhood of damp vlei land either by drinking water or eating grass in the vicinity. The egg of the wire-worm will remain fertile for a very long period if kept dry outside of the animal body, and it is quite a common occurrence to have sheep quite free from the parasite during a drought and at once become infested after the rain. The reason for that is this: when the moisture dries off the veld the wire-worm eggs sink down between the grass tufts on the surface of the earth itself; rain comes and these eggs hatch out; the larvae climb to the top of the growing grass and are eaten and ingested by the sheep. A number of them may be destroyed by the act of rumination of the worm, which in this stage is very minute, and the great majority will escape the action of the sheep's teeth. Dr. Theiler points out that when a farm has been free of ruminants for a year the wire-worm will disappear, and his experience has proved this to be the case. Mr. Botha, in the concluding paragraph of his letter, says: "Sheep have for two or three years been free of wire-worm, and then, after much rain, the worms were found in great numbers in those sheep." It is very rare, indeed, to open a sheep without finding one or more wire-worms in the fourth stomach; it may be that the sheep in Mr. Botha's experience were passing small quantities of wire-worm; these were unable to hatch out on account of the rain, but made their presence felt after the rain. The life-history of the wire-worm is engaging the attention of this Division, and we find that in some respects its life-cycle varies from that attributed to the same species of parasite in Europe.]

WEED SEEDS IN IRRIGATION WATER.

To the Editor of the *Agricultural Journal.*

SIR,—I am informed that at one particular spot on the Vaal River there is an important pumping plant which supplies water from the river to the farm. The large quantity of seeds of weeds brought down by the river this season has turned the farm into a mass of weeds! My object in writing is to caution farmers who may intend taking water direct from rivers. Arrange that you do not pump weeds as well as water on to the land.—Yours, etc.,

KENNETH AUSTIN.

P.O. Box 4305, Johannesburg.

CATTLE DIPPING TANKS FOR SHEEP DIPPING.

To the Editor of the *Agricultural Journal.*

SIR,—Can you please give me any information relative to dipping merino sheep in a cattle tank 50 feet long and the same dip used for cattle, viz., 150 lb. arsenite of soda (80 per cent), 66 lb. soft soap, 30 gallons paraffin, which, as per directions, are the quantities for 5000 gallons water for fourteen days' dipping?

Would this tank and cattle dip be suitable for dipping merino sheep for scab? Or would you recommend us building a sheep tank and using the recognized sheep dips?—Yours, etc.,

C. H. OATES, Sen.

Inverness, Palmyra Bag, Vryburg.

[The Chief of the Sheep Division (Mr. B. Enslin) replies: It is not considered desirable for farmers to uses cattle tanks for the dipping of sheep, because there is always a danger of hairs from the cattle entering the fleeces of woolled sheep and thus damaging the wool; and there is secondly to be considered the expense to which the farmer would be put if it became necessary for his sheep to be dipped under supervision and consequently for his cattle tank to be filled with sheep dipping fluid. Lime and sulphur, and caustic soda and sulphur, prepared in accordance with the official formula, are considered to be the most effective scab-destroying preparations.]

CONSTRUCTION OF SILOS.

The Government Agrostologist and Botanist (Mr. J. Burtt-Davy) has received the following letter:—

SIR,—We are particularly interested in your article in the current number of the *Agricultural Journal*, as silage is especially important here this year owing to the deficient rainfall, and we are starting to make a silo.

We were planning a pit 30 feet deep and 18 feet in diameter, but now gather that you recommend a *rectangular* pit (pp. 75-87), a small pit, say 8 feet deep.

Naturally the shallow depth is a great deal cheaper and quicker to make, and I write to ask if we have rightly appreciated your article to mean that we can safely make rectangular silos of 8 feet depth. Your assurance on these points would greatly oblige—Yours, etc.,

H. H. PHEAR.

Jacobsval, Brussels Siding, P.O. Vryburg.

[Mr. Burtt-Davy replied as follows:—It is cheaper to make a pit 8 feet deep than one 30 feet, and it is easier and cheaper to extract the silage when made. The silage is just as good from an 8 feet pit, and Messrs. John Fowler & Co., who make 600 tons per annum, never make their pits deeper than 7 or 8 feet. For practical purposes I prefer a long narrow pit, not more than 6 or 8 feet wide, because there is less silage exposed to the air when you begin to use it, which is most important.]

HICKORY KING MAIZE SPROUTING.

To the Editor of the *Agricultural Journal.*

SIR,—I have planted ten acres of Hickory King mealies on fairly good soil. The mealies are now about 2 feet high, and I find that they are giving

two and three sprouts below the stem. Is it necessary to remove the sprouts? And what is the cause of it? To remove the sprouts means no end of labour.—Yours, etc.,

W. J. BICCARD.

P.O. Zandfontein, via Pietersburg.

[The Government Agrostologist and Botanist (Mr. J. Burtt-Davy) replies:—The tendency to sprout is a characteristic of certain breeds of maize, particularly some of the flints, and appears to be an inherited character. Where maize is grown for silage the stooling habit is a desirable one, but where the crop is grown for grain only it is generally considered desirable to grow only a single stem, especially as the lateral shoots are apt to produce hermaphrodite inflorescences which do not develop good grain and weaken the plant. It is an expensive matter to remove the suckers, and you will have to decide for yourself whether it is going to pay to do it. You are likely to get a better crop if you do. In future it would be desirable to get your seed from a strain of Hickory King which does not have the suckering habit.]

WINDMILLS.

To the Editor of the *Agricultural Journal.*

SIR,—Would you kindly inform me what is the greatest quantity of water a windmill can pump under favourable circumstances, say, with 15 feet suction and to force 35 feet high? I would like to pump the greatest quantity of water. Please give me full information.—Yours, etc.,

D. J. JOUBERT.

Weltevreden, Barrydale, C.P.

[The Lecturer in Engineering at the Potchefstroom School of Agriculture (Mr. W. H. S. Cleghorne) replies:—The Royal Agricultural Society of England carried out competitive tests on wind engines (driving pumps) in 1903. Twenty-two wind engines went through the competition, of which seven had wind-wheels of 16 feet diameter, the others having wheels ranging from 8 to 30 feet diameter. The six best windmills were selected, and it is worthy of note that all six had wind-wheels of 16 feet diameter. The pumps were set to pump against a resistance equivalent to pumping to a height of 200 feet (suction plus delivery), the quantity of water pumped during a day of ten hours being registered by a meter in each case. The average velocity of the wind on each day was recorded by anemometers. The following are the performances of two of the six selected mills. The quantity pumped 50 feet I have calculated as four times that pumped 200 feet:—

Average Wind Velocity Miles per hour.	Windmill No 1. (Winner of Competition.)		Windmill No. 2.	
	Gallons pumped 200 feet in 10 hours.	Gallons pumped 50 feet in 10 hours, calculated from column 2	Gallons pumped 200 feet in 10 hours	Gallons pumped 50 feet in 10 hours calculated from column 4.
8	—	—	2,214	8,856
6	1,428	5,712	1,181	4,724
8	2,545	10,180	1,913	7,652
9	3,608	14,432	2,309	9,236
8	2,891	11,564	—	—
24	10,047	40,188	4,447	17,788
22	7,622	30,488	4,399	17,596
7	3,160	12,640	1,850	7,400

A full account of the above tests is to be found in the *Journal of the Royal Agricultural Society of England*, volume 64, page 174. It is not advisable to rely on an average wind of over eight miles per hour for a working day of eight to ten hours throughout the whole year so long as data on this point for this country are so meagre.]

A FRISKY MARE.

To the Editor of the *Agricultural Journal*.

SIR,—I have a valuable imported mare (Irish hunter), a very docile animal, never kicking while being groomed, but, while tame in handling, she turns a perfect brute when run in the veld together with other horses.

Some time ago, while kicking other horses, she got entangled in the barbed-wire fence, and it took me four months to cure the cuts she sustained. For that purpose I had to keep her in the stable, and being cured and in prime condition I turned her into the veld again. Apparently her recovered freedom got so on her nerves that—from pure gladness, I presume—she started kicking a two-year-old half-blood mare of mine and broke one of its hind legs, so that I had to shoot it.

To prevent any further damage being caused by her exploits I now keep her constantly in the stable.

As I bought this mare for breeding purposes it naturally causes much inconvenience having to confine her to the stable. I would, therefore, deem it a favour if you could suggest any scheme or remedy by which she could be cured or prevented from her kicking folly. Thanking you in anticipation,—Yours, etc.

J. A. H. JORISSEN.

Bethulie.

[We should be glad to have views of readers on the kicking propensities of our correspondent's mare. Perhaps some one who has had experience of such an animal can suggest a remedy.—EDITOR, *Agr. Jnl.*]

TAMWORTH LUCERNE.

To the Editor of the *Agricultural Journal*.

SIR,—In "Questions and Answers" in the November *Journal* there was an inquiry by Mr. C. S. Erasmus as to the best lucerne for winter. I do not know of any such lucerne, but can recommend a kind which I have proved by experiment to be the nearest to that which he wants, namely, the "Tamworth."

In 1906 I got 5 lb. from the Cape Government for experimental purposes. I sowed the seed in October, 1906, and irrigated it. It grew well. This was the first and also the last time that piece of lucerne was irrigated. In 1907 the flood water went twice over it and a furrow was washed around the field of lucerne, so that irrigation became impossible after that. But there that piece of lucerne (about one acre) stands. I am cutting it for the third time this season, and anybody is welcome to come and see it. The first time I cut it on 2nd September, then again on the 3rd November and in December. And this without a drop of water throughout the drought! It is about 2 feet 3 inches high. All cattle seem to like it very much. When used as hay I think it should be cut as soon as it starts to flower, because it grows a thicker stem than Provence.

In 1910 I had it eaten off about nine times, a proof that it grows very quickly. It starts growing about the 20th July and grows until the end of May. Another proof: On the same soil, but on the other side of the furrow, I sowed Provence and irrigated it, and thus far have only cut it once.—Yours, etc.,

J. H. VAN DER WALT.

Welvenpas, P.O. Sherborne, C.P.

RIB-GRASS IN LUCERNE.

The Government Agrostologist and Botanist (Mr. J. Burtt-Davy) has received the following letter:—

SIR,—I saw in a field of lucerne in the Thaba 'Nchu District to-day a weed (as per specimen enclosed). This weed is taking possession of the field in spite of the efforts of the owner to keep it down.

I heard of another field of lucerne in the same district where the weed has already taken possession of the field.

As this may be of interest to your Department I am enclosing a small plant with seed.—Yours, etc.,

T. A. HARTLEY.

Piedmont, Wepener, Orange Free State.

[Mr. Burtt-Davy replied:—The plant sent with your letter is known as rib-grass (*Plantago lanceolata*). It keeps green in winter and is eaten by stock, but it becomes a troublesome weed in lucerne fields.]

INDIAN BAMBOO AND SPINELESS CACTUS.

To the Editor of the *Agricultural Journal.*

SIR,—Will you be so good as to give me information, through the medium of the *Journal*, on the following:—

(*a*) I have read of the value of *Indiesche riet* (Indian bamboo). Can you or any of your readers inform me where bamboo cuttings can be obtained? I would like to try it for winter fodder.

(*b*) I am told that a certain farmer in the Bedford District has imported a spineless cactus, having leaves 3½ inches thick. I should be glad to have the address of the gentleman in question. If he is a reader of the *Journal* I shall be pleased if he will give me any information on the growing of cactus, and whether it is frost-resistant. Thanking you in anticipation,—Yours, etc.,

C. H. DE VENAGE.

Wolvekop, P.O. Sherborne, C.P.

[(*a*) *Indiesche riet* is grown mostly in the Oudtshoorn, Robertson, and Ladismith Districts. Perhaps a reader in one of these districts would kindly inform our correspondent where cuttings are procurable. (*b*) Some varieties of spineless cactus have been imported by the Grootfontein School of Agriculture and are being propagated there. These are not yet available for distribution.—EDITOR, *Agr. Jnl.*]

THE VALUE OF CABBAGES.

To the Editor of the *Agricultural Journal.*

SIR,—My practical experience and research with the above vegetable has been only a limited one of scarcely two years, but in that time I obtained sufficient to supply my wants. The points to be considered are:—

(1) The ground you select.
(2) The seed to select to suit the locality, and whether for stock feed or human consumption, is of importance to obtain good results.
(3) The boxes or beds, prepared to germinate the seed. The first I consider the best, but you must find out by experimenting, as it seems to be a divided question.
(4) The time and season have no effect on the coast. You can grow them all the year round provided you select the proper site, as they are drought-resistant once established.
(5) The transplanting process is the secret of success.
(6) The correct time to cut cabbages leaving the stump to produce healthy sprouts.
(7) The production of healthy sprouts to reproduce good hearts.

(1) The ground should be of a loose texture, with plenty of humus sweetened with a little lime, well drained and cultivated to obtain good results. I turn under as much green stuff as possible, such leguminous crops as cow peas (black) giving a very heavy yield of peas, and thus furnishing the ground with all the chemical manure you require, and this is the cheapest and best as a rotation crop. On a sandy, loamy soil which is sour a little compost manure mixed with a little lime is very good, and that is in reach of every one. Look after the kitchen refuse and see it put into a pit along with the sweepings of the yard mixed with a little soil, and let it lie there for twelve months or longer if possible. Very often pumpkins are seen to grow well there.

(2) I have only tried three varieties so far—the Drumhead, Mammoth, and Sugar-loaf—and I found the three did very well on the same soil and treatment and were grown throughout the year. Some of them weighed between 5 lb. and 8 lb., grown at a height of 100 feet above sea-level. I found the former two were splendid for stock, especially cows in calf and up to the time of weaning. Given in moderation with other food, but separately in the raw state, is better than skim milk, and the production cheaper.

(3) I found I had obtained better results and saving of time and labour by germinating the seed in boxes or tins, such as paraffin tins cut in half. In this way you can move them about to places of safety away from storms, as so often you hear of whole beds destroyed, disheartening the grower, who had taken great care in preparing the beds. Good, strong, healthy plants stand transplanting better and grow very rapidly. The mere fact of taking the seedlings and placing them in a prepared bed is quite enough to kill them or throw them back, if not quickly and lightly handled, and the plant must not

be touched by the hands. Have your furrows or drills ready, then place your tin of seedlings opposite, extricating them by means of a reed, cut like a G pen-nib, placing the soil with a slight pressure of the fingers. Then draw out the reed and fill in the soil lightly up to the first leaves. This should be done in the evening. A weak solution of Safco I found very good.

(4) The autumn sowing I find the best, as the plants are free from the blue aphis, which attacks them after the first rains, and a solution of salt will no doubt help. Once established in good drained, cultivated soil, no water is needed, as they are a natural reservoir in themselves, and the same applies to the cabbage lettuce. *Study Dry Farming!* It will help you in the production of this and all vegetables, and the cost of production will be considerably reduced.

(5) *Transplanting.*—I have already given a little information that might be of help to one interested in the production of this most valuable crop. In fact, I find it pays better to feed the stock than to grow for market, as you obtain fine healthy animals for your trouble.

(6) Cut your cabbages always with a sharp knife or sickle. When you see the young sprouts commencing to show on the stalk, smear over with mud, to prevent bleeding, and bank up well. When the sprouts are about an inch long pinch off the smallest, only leaving three or four on a stump, and when they are commencing to form hearts pull them off. Do not cut them and plant the same as in paragraph (3). By doing this you save having to sow seed, and they are more readily grown and sweeter.

I will not take up any more of your valuable space; and trust this will be of material help.—Yours, etc.,

SMALLHOLDER.

Pinetown, Natal.

The Weather during December.

By C. STEWART, Chief Meteorologist. Department of Irrigation.

OVER Natal the day temperatures during the month of December were lower and the night temperatures higher than usual, whereas over the Union generally both day and night were higher. The mean monthly temperature was about one degree sub-normal along the east and south coasts and over Natal; and about one degree above the normal over the remainder of the Union. There was a general hot spell at Christmas.

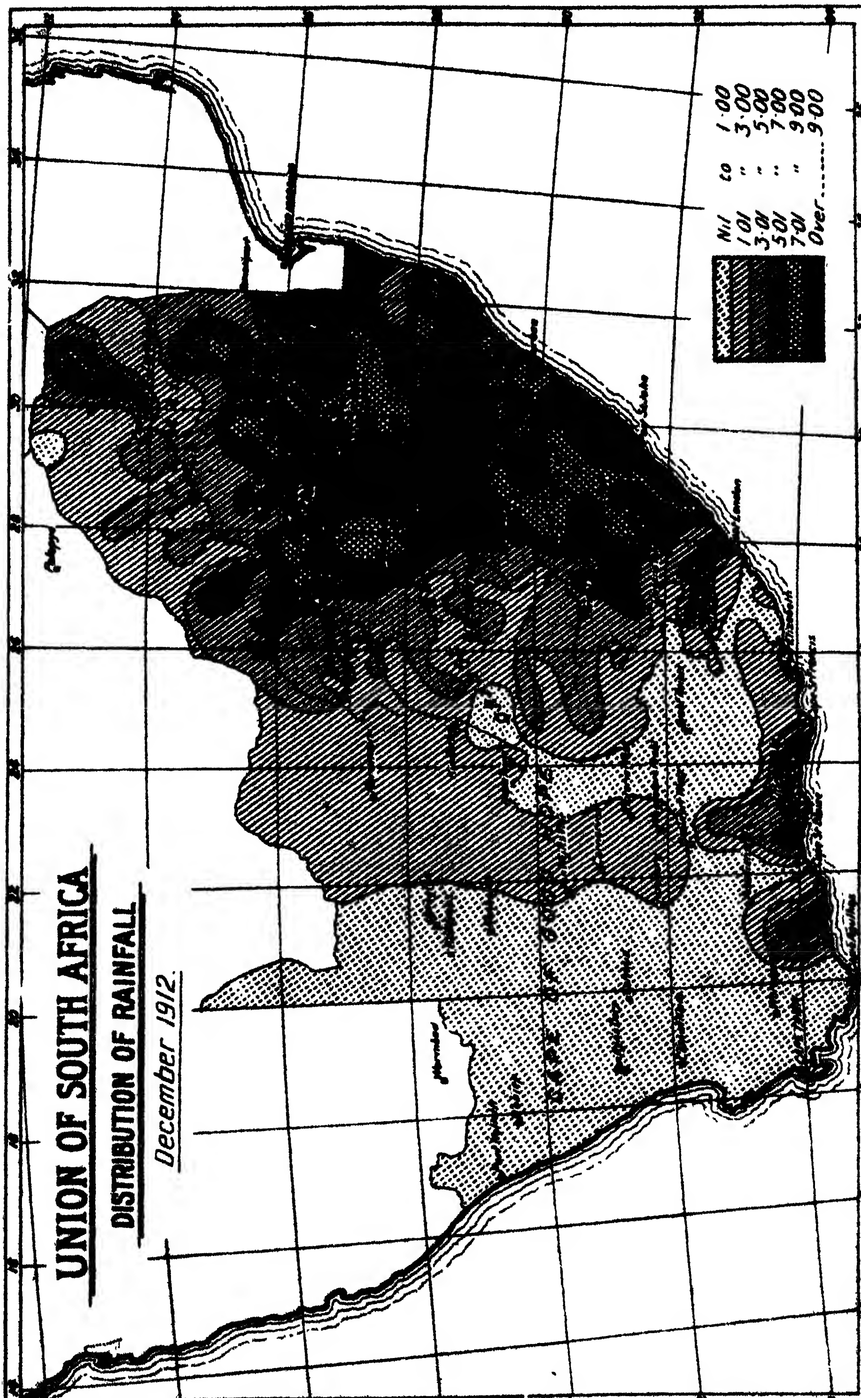
The rainfall over the high veld and in Natal was generally slightly above the December monthly average, and there were instances of considerable local excesses. Over the remainder of the Union the records show slight deficits. The rainfall was fai ly well distributed over the month and heavy rains were generally experienced towards the end. In the Transvaal severe thunderstorms occurred and several fatalities through lightning were reported. The general drought is now broken, but its effects are well exemplified in a report received from Mr. W. A. Stillwell. Kruidfontein, P.O. Reddersburg, Orange Free State, which is quoted verbatim: "Although the rainfall during the year has been 11·53 inches the effect on the veld has been of very little use owing to the intervals between the showers, the intense heat and dry winds absorbing all the moisture almost as soon as it fell. Only during February and part of March was the country really green, and then heavy frosts completely killed the young grass early in April, leaving us nearly destitute of feed for the winter. All the cattle in this district had to be sent away and a large number of them died from absolute poverty. All farmers about here have failed to reap any crops whatever, having fed them all off with their stock, and now the season for sowing has practically gone and there is not an ox in the district able to work on the ploughing. As even with good rains it will be at least a month before the veld will be capable of sustaining the cattle when brought back, the outlook for the coming season is bad."

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN THERMOMETER SCREENS)—DECEMBER, 1912.

PLACE.	OBSERVER.	MONTH—DECEMBER, 1912.			Normal Monthly Temperature.	Difference from Normal.	EXTREMES.			
		Mean Max.	Mean Min.	Monthly Temperature.			Highest.	Date.	Lowest.	Date.
		°	°	°	°	°	°		°	
Transvaal—										
Louis Trichardt	Sergt. J. C. N. Clark ...	85·4	62·6	74·0	71·9	+2·1	95·0	5th	51·0	24th.
Pietersburg	W. Frankleyne	83·7	60·0	71·9	70·2	+1·7	93·4	4th	52·0	23rd. 24th, & 25th.
Belfast	G. J. Imrie...	71·6	50·9	61·2	61·2	+0·0	78·8	26th	42·9	24th.
Zeerust	H. Dietrich, J.P.	88·9	62·8	75·8	74·2	+1·6	97·0	27th	55·4	2nd.
Pretoria (Arcadia) ...	J. Lyall Soutter	84·1	58·5	71·3	71·1	+0·2	91·7	28th	51·1	31st.
Johannesburg(Observatory)	Staff	75·7	54·3	65·0	64·8	+0·2	85·4	11th	45·4	24th.
Potchefstroom	J. R. Henning	87·4	59·5	73·5	70·1	+3·4	96·2	11th	51·1	24th.
Christiana	S. W. Davis	93·4	62·6	78·0	75·1	+2·9	102·0	11th	51·0	21st.
Komatipoort	B. J. Fothergill	92·8	70·0	81·4	80·6	+0·8	105·5	4th	61·0	26th.
Swaziland—										
Mbabane	A. C. Hulett	78·1	55·7	66·9	66·0	+0·9	88·0	4th	42·0	25th.
Orange Free State—										
Bloemfontein	H. Arndt	85·3	59·3	72·3	71·9	+0·4	93·8	17th	46·1	23rd.
Lindley	J. Oates	81·9	55·6	68·8	67·7	+1·1	92·0	9th	46·0	20th.
Harrismith	J. B. Patterson	72·2	50·5	61·4	63·6	—2·2	84·0	4th	40·0	20th & 24th.
Natal—										
Hlabisa	E. D. Lightening	81·4	63·8	72·6	—	—	92·0	4th	55·0	29th & 31st.
Maritzburg	Natal Asylum	81·6	59·7	70·6	71·8	—1·2	97·0	25th & 26th	48·0	25th.
Durban (Point)	Capt. D. Black	80·0	67·9	73·9	—	—	90·0	16th	59·0	24th.
Cape—										
Aliwal North	A. Brown	84·8	55·3	70·0	68·3	+1·7	95·0	3rd and 4th	42·0	1st & 24th.
Kokstad	H. D. Coyte	75·9	53·3	64·6	63·2	+1·4	91·6	10th	41·2	24th.
Murraysburg	—	—	—	—	—	—	—	—	—	—
Clanwilliam	W. J. Downes	93·1	61·0	77·0	73·2	+3·8	105·0	25th	55·0	1st & 2nd.
Queenstown	H. Holley	83·3	56·4	69·8	68·4	+1·4	100·0	10th	42·0	24th.
Bedford	T. C. Hall	83·3	54·9	69·1	68·3	+0·8	105·0	25th	42·0	24th.
East London	M. G. Grogan	73·3	62·0	67·6	68·5	—0·9	82·0	11th	52·0	24th.
Amalienstein	—	—	—	—	—	—	—	—	—	—
Groot Drakenstein... ...	Lionel Baker	85·5	60·6	73·0	70·4	+2·6	98·3	15th	47·2	1st.
Capetown (Observatory) ...	Staff	79·3	60·2	69·8	67·3	+2·5	93·4	24th	49·7	1st.
Wynberg	Sister Mary Imelda ...	78·7	57·3	68·0	66·3	+1·7	89·0	24th	48·8	1st.
Mossel Bay...	G. Draper	73·9	58·5	66·2	67·5	—1·3	90·0	25th	51·0	3rd.
Port Elizabeth	P. E. Morgan	73·9	61·1	67·5	67·7	—0·2	86·0	25th	52·0	23rd & 24th.

RAINFALL RETURN FOR DECEMBER, 1912.

PLACE.	OBSERVER.	MONTH.			YEAR.		
		Dec., 1912.	Normal.	Difference from Normal.	From 1st Jan., 1912.	Normal.	Difference from Normal.
Transvaal—		ins.	ins.	ins.	ins.	ins.	ins.
Komatipoort ...	B. J. Fothergill ...	3·93	4·34	—0·41	15·20	24·94	—9·74
Christiana ...	S. W. Davis ...	0·91	1·37	—0·46	17·93	17·67	+0·26
Belfast	G. J. Imrie ...	10·26	5·72	+4·54	30·25	31·23	—0·98
Pilgrims Rest ...	Trans G.M.E., Ltd.	7·90	5·65	+2·35	30·31	39·97	—9·66
Zeerust	H. Dietrich, J.P.	4·68	3·20	+1·48	16·71	24·38	—7·67
Middelburg ...	Dr. H. A. Spencer	5·27	4·52	+0·75	27·10	28·93	—1·83
Potchefstroom ...	H. R. M. Bosch ...	6·94	4·22	+2·72	28·57	25·25	+3·32
Pretoria (Arcadia)	J. Lyall Soutter...	4·01	4·21	—0·20	21·97	28·94	—6·97
Standerton ...	A. van Backstrom	5·83	4·60	+1·23	24·22	31·30	—7·08
Johannesburg ...	Observatory Staff	4·81	4·00	+0·81	21·64	28·98	—7·34
Louis Trichardt ...	Transvaal Police	2·40	4·68	—2·28	20·58	26·70	—6·12
Pietersburg ...	W. Frankleyne ...	3·42	4·21	—0·79	10·47	20·65	—10·18
Swaziland—							
Mbabane... ...	Swaziland Police	5·35	7·11	—1·76	35·40	49·12	—13·72
Cape—							
Mafeking ...	A. Webster ...	3·36	3·22	—0·04	16·01	21·37	—5·36
Vryburg	J. T. Morrison ...	2·01	3·16	—1·15	16·84	25·50	—8·66
Pella	Rev. Bishop Simon	0·18	0·13	+0·05	0·98	3·31	—2·33
Prieska	M. Drummer ...	1·26	0·89	+0·37	8·49	10·25	—1·76
Hopetown ...	C. B. Scott ...	1·23	1·48	—0·25	10·14	13·62	—3·48
Clanwilliam ...	W. J. Downes ...	0·42	0·19	+0·23	7·45	8·59	—1·14
Calvinia	W. Harvey ...	0·46	0·18	+0·28	5·46	7·92	—2·46
Fraserburg ...	P. J. Booyzen ...	1·04	0·36	+0·68	4·38	7·21	—2·83
Carnarvon ...	J. Sullivan ...	1·14	0·52	+0·62	2·84	8·74	—5·90
Victoria West ...	F. A. Houghton...	1·20	1·02	+0·18	5·91	11·04	—5·13
Philipstown ...	Gaoler ...	4·50	1·46	+3·04	10·85	14·12	—3·27
Aliwal North ...	J. P. Casteling ...	4·53	3·29	+1·24	18·26	25·26	—7·00
Queenstown ...	H. Holley ...	2·93	3·28	—0·35	15·80	24·53	—8·73
Kokstad ...	H. D. Coyte ...	7·15	4·35	+2·80	26·45	27·09	—0·64
Port St. John ...	F. J. Lloyd ...	1·30	4·56	3·26	16·87	46·31	—29·44
Piquetberg ...	A. H. Morris ...	0·10	0·68	—0·58	21·91	20·59	+1·32
Worcester ...	W. B. Sutton ...	0·15	0·54	—0·39	11·81	10·94	+0·87
Capetown ...	Observatory Staff	0·06	0·87	—0·81	21·91	26·85	—4·94
Wynberg ...	Sister Mary Imelda	0·09	1·15	—1·06	46·08	41·73	+4·35
Sutherland ...	C. R. Bester ...	0·50	0·50	±	6·14	9·92	—3·78
Swellendam ...	H. Montgomery...	3·35	2·44	+0·91	31·52	32·14	—0·62
Mossel Bay ...	G. Draper ...	2·00	1·32	—0·68	17·81	17·04	+0·77
Beaufort West ...	W. T. Golledge ...	0·52	0·94	—0·42	7·03	8·69	—1·56
Graaff-Reinet ...	J. A. Simpson ...	0·31	1·60	—1·29	8·65	16·26	—7·61
Steytlerville ...	P. R. de Wet ...	0·70	0·95	—0·25	9·03	9·05	—0·02
Port Elizabeth ...	P. E. Morgan ...	1·47	1·66	—0·19	22·30	20·24	+2·06
Bedford ...	S. Morris... ...	2·67	2·99	—0·32	25·74	27·67	—1·93
Orange Free State—							
Bloemfontein ...	H. Arndt... ...	2·87	2·52	+0·35	14·42	22·69	—8·27
Harrismith ...	J. B. Patterson ...	4·58	3·01	+1·57	28·27	28·13	+0·14
Winburg... ...	J. J. Swartz ...	3·25	2·52	+0·73	26·03	23·26	+2·77
Lindley	Jno. Oates ...	7·33	3·47	+3·86	29·86	25·42	+4·44
Natal—							
Hlabisa	E. D. Lightening	7·13	5·96	+1·17	39·84	39·51	+0·33
Maritzburg ...	Govt. Asylum ...	3·82	5·43	—1·61	29·53	31·14	—1·61
Durban (Point)...	Capt. D. Black ...	8·73	—	—	—	—	—
Bulwer	A. Brown ...	8·08	—	—	—	—	—
Port Shepstone ...	A. B. Cox ...	14·15	3·86	+10·29	—	—	—


UNION OF SOUTH AFRICA
DISTRIBUTION OF RAINFALL
December 1912.
Nil to 1·00
1·01 " 3·00
3·01 " 5·00
5·01 " 7·00
7·01 " 9·00
Over .... 9·00

MARCH WEATHER CHARACTERISTICS.

In the Transvaal the rainy season is now declining and the precipitation is not so heavy as during the three preceding months. Wet spells, however, with soft rains lasting several days, sometimes occur. Over the remainder of the Union there is a general increase on the February rainfall, the normal rising to a maximum over the Cape northern border and on the north and central Karroo, and to a secondary maximum in the north-east and south-east of the Cape, in the Orange Free State, Zululand, and Swaziland. In Zululand about 6·0 inches, in Swaziland 5·5 inches, in Basutoland 5·0 inches, in Natal 4·5 inches, over the Transvaal, Kaffraria, and in the north-east of the Cape Province 4·0 inches, over the Orange Free State and in the south-east of the Cape 3·5 inches, over the Cape northern border 3·0 inches, over the north and east central Karroo 2·5 inches, along the south coast 2·0 inches, over the west central and south Karroo and the Cape Peninsula 1·5 inches, and in the south-west of the Cape and along the east coast less than 1·00 may be expected. Thunderstorms are still of frequent occurrence.

Throughout the Union the mean daily temperature is falling. It may be expected to reach about 73 degrees over the northern border of the Cape and the south Karroo, 72 degrees in Natal, 70 degrees over the east central Karroo, 69 degrees along the west coast and in the south-west of the Cape, 68 degrees along the south coast and in the south-east of the Cape, 67 degrees in the Orange Free State and on the Transvaal high veld, the north Karroo and the Cape Peninsula, 66 degrees in Kaffraria, 65 degrees over the north-east of the Cape, 64 degrees in Basutoland, and 62 degrees over the east central Karroo.

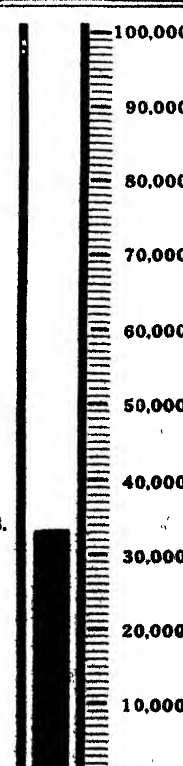
In the Cape Province the prevailing winds are north-easterly over the south-east, north-north-westerly over the northern border and southerly over the peninsula. Over the Transvaal they are from the north-east and east.

Within the summer rainfall zone the quantity of clouds should be noticeably diminishing, and over the Transvaal and the Cape northern border the number of hours of bright sunshine should be about 75 % of the total number possible.

CIRCULATION GAUGE.

DO YOU READ THE
AGRICULTURAL JOURNAL?

FEBRUARY, 1913.



IF NOT,
WHY NOT?

South African Produce Markets.

CAPETOWN.

The Produce Department of the firm of R. Müller, Capetown, reports under date of the 28th January, 1913, as follows :—

Ostrich Feathers.—The next London auction sales will open on the 3rd proximo. Consequently, the market here is somewhat in a state of uncertainty. Yet satisfactory prices have locally been paid for all classes of feathers. Blacks and drabs may be reported to have shown a weakening tendency, but for all that the market is in a sound state, and any good quality feathers are well competed for.

Taking everything into consideration, the market is in favour of sellers. Capetown is always favourably influenced by the local trade, which is constantly extending.

Prices now ruling are as follows, viz. :—

	£	s.	d.		£	s.	d.
Primes	16	0	0	to	30	0	0
First	12	0	0	„	16	10	0
Second whites	7	0	0	„	10	10	0
Third whites	2	5	0	„	5	10	0
Inferior and stalky whites	0	15	0	„	2	10	0
Byocks and fancy	2	0	0	„	10	0	0
Superior feminas	10	0	0	„	16	10	0
First feminas	7	10	0	„	9	10	0
Second feminas	3	0	0	„	7	0	0
Third feminas	1	10	0	„	2	10	0
Greys	2	0	0	„	9	0	0
White boos	1	0	0	„	3	0	0
Light boos	0	15	0	„	2	0	0
Dark boos	0	3	0	„	0	15	0
Inferior boos and tipless	0	2	0	„	0	10	0
Long blacks	2	10	0	to	5	0	0
Medium blacks	1	10	0	„	3	0	0
Short blacks	0	2	6	„	1	5	0
Long floss blacks	1	5	0	„	2	10	0
Medium floss blacks	0	12	6	„	1	2	6
Short floss blacks	0	5	0	„	0	10	0
Long drabs	1	10	0	„	3	10	0
Medium drabs	0	7	6	„	1	5	0
Short drabs	0	2	6	„	0	7	6
Long floss drabs	1	7	6	„	2	0	0
Medium floss drabs	0	12	6	„	1	0	0
Short floss drabs	0	5	0	„	0	12	6
Inferior long blacks and drabs	0	10	0	„	1	15	0
Common blacks and drabs	0	1	0	„	0	5	0
Spadonas	0	5	0	„	2	10	0

Wool.—At the London wool sales which took place during this month of January there were, in all, 135,000 bales available, whereof 11,000 bales consisted of Cape wool. Australian and New Zealand merinos were well competed for by the home and continental trades. They realized from par to ½d. advance. Crossbreds were sold at par to ½d. decline. The demand for South African offerings was very satisfactory; the tendency proved firm throughout. Cape snowwhites sold ½d. to 1d. dearer.

Capetown prices are very firm owing to a sound competition.

The sales effected have not been very extensive, but the following are the prices which are now being obtained here in Capetown :—

	d.		d.
Calvinia, long	6¼	to	7
Calvinia, medium	6	„	6½
Karroo and Roggeveld	6	„	9¾
Short burry wools, heavy	4	„	4¾
Short burry wools, light	4¾	to	5¼
C. and C., best grease	4¾	„	5⅝
C. and C., medium	3½	„	4¾
C. and C., inferior	1	„	3

Skins.—Average quantities of skins have changed hands in Capetown for the export trade at the high prices which were obtainable in this market, according to my last report.

Sellers have every reason to be highly pleased with the state of affairs, and they should not delay in sending all they have to the Capetown market in order to make sure that they may obtain the excellent prices which are now to be had here, as will be seen from the following quotations :—

Goatskins, light	14d. per lb.
Goatskins, heavy	12d. per lb.
Sundried and kids	8d. per lb.
Angoras	7d. per lb.
Angoras, bastard	10d. per lb.
Angoras, shorn	6d. per lb.
Longwools, Karroo	7¾d. per lb.
Short-wools	5½d. per lb.
Pelts and damaged	4½d. per lb.
Caledon	7¾d. per lb.
Bastards	6½d. per lb.
Capes, large	3s. 5d. each.
Capes, medium	2s. 6d. each.
Capes, cut	1s. 6d. each.
Capes, damaged and lambs	9d. each.

Hides.—Exporters are still paying for sound hides as much as 9½d. per lb., whilst damaged hides fetch from 6d. to 8d. per lb.

PORT ELIZABETH.

Messrs. John Daverin & Co. report under date 25th January:—

Ostrich Feathers.—This week's market again passed off very well, the usual three days sale being held, and the whole of the offerings disposed of at very satisfactory prices. Tails and spadonas continue to demand extreme prices, whilst all wings, drabs, etc., of fair quality, remain very firm.

Among the numerous parcels we disposed of this week was a fine plucking grown by Messrs. Featherstone Brothers, of Walsingham, Pearston, which was much admired by buyers, and which realized extreme prices. The whites averaged £13. per lb. all round, feminas £9, tails £2. 5s., blacks £4, and drabs £2. 10s.

Stocks are now very moderate, and new arrivals limited.

The next London sales open on the 3rd proximo.

The total quantity sold on our market this week amounted to £28,455. 18s. 4d., and weighed 9691 lb. 8 oz.

We quote the following as current prices for:—

	£	s.	d.		£	s.	d.
Primes:							
Extra super	20	0	0	to	30	0	0
Good	14	0	0	„	17	10	0
Whites:							
Good to super	10	0	0	„	12	10	0
Good average	8	0	0	„	9	0	0
Average	6	5	0	„	7	10	0
Common and narrow	3	15	0	„	5	5	0
Good broken	7	0	0	„	9	10	0
Thirds	2	5	0	„	4	0	0
Fancies:							
Good	5	10	0	„	6	15	0
Ordinary	4	0	0	„	5	0	0
Feminas:							
Super	10	0	0	„	12	10	0
Good average	6	10	0	„	8	10	0
Average	4	5	0	„	5	10	0
Common and narrow	2	0	0	„	3	15	0
Good broken	4	10	0	„	7	0	0
Thirds	1	10	0	„	2	15	0
Greys:							
Good	4	10	0	to	6	10	0
Ordinary	2	15	0	„	3	15	0
Tails:							
Male, good, big, bold	2	15	0	„	4	5	0
Male, good average	2	0	0	„	2	10	0
Short and narrow	0	17	6	„	1	15	0
Female, light, good, big, bold	2	5	0	„	3	5	0
Female, light, good average	1	15	0	„	2	0	0
Female, light, short and narrow	0	10	0	„	0	17	6
Tails (contd.):							
Female, dark, good, big, bold	1	0	0	to	1	15	0
Female, dark, good average	0	15	0	„	0	17	6
Female, dark, short and narrow	0	7	6	„	0	12	6
Blacks:							
Long (special)	4	10	0	„	6	10	0
Long, good	3	0	0	„	3	15	0
Long, fair	1	15	0	„	2	10	0
Long, drabby	1	0	0	„	2	5	0
Medium	1	5	0	„	2	5	0
Short	0	10	0	„	0	15	0
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Drabs:							
Long, special	2	15	0	„	4	5	0
Long, good	2	0	0	„	2	10	0
Long, fair	1	5	0	„	1	15	0
Medium	0	17	6	„	1	10	0
Short	0	5	0	„	0	12	6
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Spadonas:							
Light (special)	3	15	0	„	5	10	0
Light, fair to good	2	0	0	„	3	5	0
Light, narrow	0	15	0	„	1	15	0
Dark	1	0	0	„	2	10	0
Chicks	0	1	6	„	0	5	0

The following may be quoted as the approximate current values of unsorted parcels per line:—

	Whites.							*Feminas.*						
	£	s.	d.		£	s.	d.	£	s.	d.		£	s.	d.
Superior pluckings	8	10	0	to	10	10	0	6	10	0	to	8	10	0
Good average lots	6	10	0	„	7	10	0	4	15	0	„	5	10	0
Poor average lots	5	0	0	„	6	0	0	3	5	0	„	4	0	0
Common lots, stalky, narrow, and discoloured	3	15	0	„	4	10	0	2	5	0	„	3	0	0

	Tails.					*Blacks.*					*Drabs.*					*Spadonas.*				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
Good ...	30	0	to	40	0	20	0	to	40	0	17	6	to	30	0	40	0	to	70	0
Average.	17	6	„	25	0	12	6	„	15	0	10	0	„	12	6	30	0	„	40	0
Poor ...	10	0	„	15	0	8	0	„	10	0	6	0	„	7	6	15	0	„	30	0

It will be understood that for special lots these quotations may be exceeded.

Wool.—The activity among buyers (especially for super wools) mentioned in our report of last week has been fully maintained this week, and prices paid were quite up to those current last week. Common and faulty wools also find ready buyers, for which prices are paid according to their condition. The improved demand and better prices for snow white is having a beneficial effect on this type of wool, which is bought mostly for speculative scouring purposes.

The Free State wools coming forward now are, many of them, somewhat damp, and some of them very damp, and buyers naturally fear buying them, not knowing to what extent the dampness may have gone through the whole bale (as the wool appears to have been packed in that condition), and the effect of it may be to seriously discolour the wool.

The condition generally of wools coming from the Free State and Transvaal is not quite satisfactory, in so far as the sorting and general get up leaves plenty of room for improvement.

As before mentioned, snow whites are in active request, and prices have advanced very considerably.

On the catalogue sales yesterday as high as 1s. 10¾d. was paid for one lot and 1s. 9¾d. for another, and so on. These are prices we have not had for some time.

There were 4257 bales offered on the catalogue sales yesterday, of which 1484 bales were declared sold.

Combing wools, light and of good condition, were firm, without any noticeable change, as, in fact, were all well conditioned wools. On the other hand, wasty wools, and those showing evidence of dampness (this refers especially to those coming from the Free State), were neglected.

By mail received this morning our London correspondent writes :—

"The year opens with every prospect of continued prosperity in the trade of the country. . . . The deficiency of 250,000 bales of Australian, which is probable, with decreases also at the Cape and River Plate, is important enough to strengthen the position of the article. We, for our part, expect wool to be cheapest in the early part of the year."

On the public sales on Thursday 331 bales were offered, of which 144 bales were sold.

We quote the following as current prices :—

	d.		d.
Snow white, extra superior ...	None offering		
„ superior	20	„	21
„ good to superior	18	„	19
„ inferior faulty	15	„	17
Grease, super choice clips	10¾	„	11½
Grease, super long, well-conditioned, grassveld grown (special clips)	10	„	10¾
Grease, super long, grassveld grown	9	„	9½
Grease, super long, Karroo grown (special clips)	8¾	„	9½
Grease, super long, Karroo grown	8	„	8½
Grease, super long, mixed veld ..	7½	„	8
Grease, light, faultless, medium, grassveld grown	7½	„	8¼
Grease, light, faultless, medium, Karroo grown	7	„	7¾
Grease, light, faultless, short, Karroo grown	6	„	6¾

	d.		d.
Light Karroo lambs	7¼	to	8¼
Cross-bred grease	6¼	„	9
Cross-bred scoured	14	„	16
Grease, coarse and coloured	5	„	6¼
Scoured, coarse and coloured	9	„	14
Basuto grease, short	6¾	„	7
O.F.S. grassveld grease, long and well-conditioned (special clips)	8¼	„	8½
O.F.S. grassveld grease, long and well-conditioned	7¼	„	8
O.F.S. grassveld grease, medium grown, light, with little fault	6½	„	7¼
O.F.S. grassveld grease, short, faulty, and wasty	5½	„	6
O.F.S. Karroo grown, long and well-conditioned	7¼	„	7¾
O.F.S. medium grown, light, with little fault	6½	„	7
O.F.S. short, faulty, and wasty ..	5	„	6

Mohair.—The inquiry mentioned in our last for both Basuto and long blue Free State hair, as well as mixed, continues ; but little or nothing has changed hands, as buyers' prices have not yet reached the limits holders are prepared to accept.

On the public market on Tuesday 17 bales were offered, of which 9 bales were sold.

The following are current values :—

	d.	d.
Super summer kids	None offering	
Ordinary kids and stained	„	„
Very mixed and stained	„	„
Superior Klips (special clips)	„	„

	d.		d.
Ordinary firsts	None offering		
Short firsts and stained	„		„
Superfine long blue O.F.S. hair ..	11½		12
Mixed O.F.S. mohair (average) ..	10	to	10½

	d.		d.		d.		d.
Mixed O.F.S. mohair, very mixed	8½	to	9½	Winter kids, good ordinary......	12½	to	13¼
Seconds and grey..............	6	„	7½	Winter mohair..................	9	„	9¼
Thirds........................	4½	„	5	Basuto mohair..................	9½	„	10¼
Winter kids, special clips (nominal)	14½	„	14¾	Basuto mohair, grey	5½	„	7

Skins.—The following are the prices we obtained this week for the several descriptions disposed of :—Sheepskins, 7¼d. per lb.; damaged, 6½d. per lb. Pelts, 4¾d. per lb.; damaged, 3¾d. per lb. Hair Capes, 3s. 1d. each ; sundried, 2s. 1d. each ; cut, 1s. each ; damaged, 8d. each. Coarse wools, 6d. per lb. Goat, 13¾d. per lb.; heavy, 11¼d. per lb.; sundried, 11¾d. per lb.; damaged, 7¼d. per lb. Bastards, 11½d. per lb.; damaged, 5½d. per lb. Angora, 8½d. per lb.; sundried and heavy, 7½d. per lb.; shorn, 6⅜d. per lb.; damaged, 4⅛d. per lb. Springbok, 9d. each. Johannesburg sheep, 5½d.; damaged sheep, 3d. Pelts, 2¼d. Goat, 10¼d.; damaged, 5¼d. Angora, 6⅜d.; damaged, 2¼d. per lb.

Hides.—Sundried, 13d. ; damaged, 12d. ; salted, 12d. ; damaged, 11d. per lb.

Horns.—3½d. each all round

EAST LONDON.

The Produce Department of Messrs. Malcomess & Co., Ltd., report as follows, under date 30th January :—

During the month under review the chief point of interest to the wool trade was the opening of the Antwerp and London wool sales. The Antwerp sales opened on the 8th inst. with a fair attendance of buyers to go through the 3000 bales offering, prices being about on a par with London closing rates of the November-December series. The London wool sales commenced on the 14th inst, the total quantities available for the first series of the present year being:

123,925 bales Australasian
10,992 „ Cape and Natal

a grand total of 134,917 bales.

The opening night's results reached us by cable as: "Combing wools opened lower by par to 5 %, snow whites opened unchanged," which, however, in our opinion was more of a readjustment of values in view of previous overestimates of yields, than an actual weakness of the market. Further cables reporting on the progress of the sales brought the news that prices were fully par for superior combing grease, par to 5 % lower for heavy combing grease, par to ½d. lower for short grease, snow whites having advanced 5 %, while the closing news advises us that London wool sales closed without any further change in prices, competition having been keen, and nearly 130,000 bales having been disposed of—which shows that manufacturing centres have displayed great keenness and wool is going into consumption very fast.

Bradford market has displayed great activity, and prices have hardened during the month from 28d. at the beginning of the month to 28¾d. to 29d. per lb. of top at the close of January.

Continental markets have been fairly strong, and the representatives of this section of the trade—especially the French section—have been paying big prices for all super and shafty wools.

Our local market has been very active during the last month and large quantities have been disposed of. All super wools have commanded extreme prices when of good condition and well got up, and even the heavy wasty descriptions, which have been very neglected of late and out of favour, have been sold when owners have been willing to meet the buyers.

Transactions for the month are as follows:—

Week ending 4th January ...			... ...		5,000 bales
Sale, 8th January,	7,300 offered,	4,000 sold	—total for week,		6,000 bales
„ 15th „	4,250 „	2,750 „	„ „		5,000 „
„ 22nd „	4,800 „	3,000 „	„ „		4,500 „
„ 29th „	5,100 „	2,500 „	„ „		6,000 „

making a grand total for the month of about 27,000 bales,

and leaving stocks in town about 7,000 bales.

The figures dealing with the shipments from the Port of East London are interesting, and show the strides made by this port.

Wool	increased from	145,000	bales in 1911 to	166,000	bales in 1912.
Mohair	„ „	5,700	„ „	6,400	„ „
Sheepskins	„ „	11,600	„ „	14,500	„ „
Hides	„ „	8,000	„ „	18,000	„ „

making with other exports a total increase of all produce of 34,000 bales for the year, viz.: from 177,000 bales in 1911 to 211,000 bales in 1912.

Our quotations are as follows:—

	d.		d.		d.		d.
Transkeis: practically nothing more available	6½	to	7¾	Super long well-conditioned grassveld	6½	to	9½
Basuto, good to average	6½	„	6⅞	Short faulty grease	4½	„	6
Super short Kaffrarian farmers'	8	„	10	Long „ „	5¼	„	7½
Super long Kaffrarian farmers'	8	„	11½	C. and C. grease (good average)	4¾	„	6
Super short well-conditioned grassveld	6	„	7¾	„ „ (very kempy)	2	„	4

Mohair.—The market for this commodity has been upset very considerably by the war complications in the Balkan Peninsula. The general tone remains quiet—a fair inquiry has been experienced for Cape hair, but prices asked by importers check business.

	d.		d.		d.		d.
Best sorted silky full 12 months grown, blue, free of kemp	11½			Sortings according to quality and length	5½	to	7½
Good long blue, silky, full 12 months grown, slightly kempy	10	to	11	Coloured hair	5		
Good to best sorted Basuto mohair, up to	10½			Good winter hair	8½	„	9
Average Basuto mohair	8½	„	10¼	Average winter hair	7½	„	8
				Super genuine winter kids	12	„	13½

Sundry Produce.—Sheep and goat and angora have remained strong, but there has been a considerable slump in the hides market, and prices which were up to 13½d. and 12½d. in the middle of December are now down fully a penny at 12½d. and 11½d. Sundried hides, 12½d.; dry-salted hides, 11½d.; goatskins, 13¾d.; angoraskins, 9½d.; bastards, 10½d.; damages, 5d. each. Sheepskins: for super first quality parcels, 7d. to 7½d.; for C. and C. skins, 5d. to 5¼d.; pelts, 4½d.; Transkeis, 4¾d. Horns, according to size and quality, 2d. to 3d. each.

DURBAN.

Messrs. Reid & Acutt's Wool Mart, Ltd., Esplanade, Durban, report as follows under date 28th January, 1913:—

Wool.—Our first sale for the year was held on 2nd instant, immediately after the holidays, when, somewhat contrary to expectation, the market opened with an animated tone; competition was brisk, and prices all round showed a hardening tendency, particularly for well-grown, light-conditioned wools.

This state of affairs has continued throughout the month, each of our auctions having been characterized by the same healthy tone and good competition; although prices all round have registered no marked advance, at the same time values generally have been firmer.

The London January sales opened there on 14th instant, and since then we have received the following cablegrams from our correspondents at that end, viz.:—

(1) "London, 15th January, 1913.—Sales have opened without alteration for grease wools; prices are irregular."

(2) "London, 16th January, 1913.—Since cabling you yesterday we quote light combing wool unchanged, but heavy descriptions 5 per cent. lower; clothing wools are unchanged."

The latter message being followed on 21st instant by a further cablegram, reading:—

"Since last cable message we quote:—

Light grease wool, combing, and clothing ...	2½ per cent. higher.
Heavy grease wool, combing and clothing ..	Unchanged.
Snowwhite, super	2½ per cent. higher.
„ medium to good	7½ per cent. higher.
„ faulty and inferior	7½ per cent. higher."

From the above it would seem that at the beginning of the auctions South African wools were irregular, with heavy descriptions showing a lower tendency, and that as the sales progressed, all light wools have picked up some 2½ per cent., leaving heavy-conditioned parcels unchanged.

This improved tone has been well reflected on our auctions, and throughout the month we have been successful in moving off the bulk of our offerings at prices satisfactory to growers. Well-grown, sorted farmers' clips are still in keen request, and, amongst others, we have made the following very pleasing figures :—

Mr. R. C. Hobday, Matatiele, E.G.

Hamels	9¼d. per lb.
Fleeces	8⅝d. „

Mr. H. G. Blake, Frankfort, O.F.S.

Hoggetts	9⅝d. per lb.
First Fleeces	9d. „
Second Fleeces	8½d. „
Short Lambs	7⅝d. „
Pieces	7½d. „
Bellies	6¾d. „

Mr. A. M. van Heerden, Wakkerstroom, Transvaal.

Fleeces	10⅝d. per lb.

Mr. D. Geldenhuys, Ermelo, Transvaal.

Lambs	9⅛d. per lb.
Fleeces	9⅛d. „
Skirts	7¾d. „

Mr. A. G. van der Bijl, Fouriesburg, O.F.S.

Fleeces	9¾d. per lb.
Lambs	9⅜d. „
Bellies	7¼d. „

Mr. F. van Reenen, Marquard, O.F.S.

Fleeces	9d. per lb.

On our weekly auctions we have offered and sold the following during the past month, viz. :—

2nd instant ...	Offered 4163 bales ...	Sold 3355 bales.
8th „ ...	„ 2252 „ ...	„ 1921 „
15th „ ...	„ 2231 „ ...	„ 1878 „
22nd „ ...	„ 2933 „ ...	„ 2630 „
	11,579	9784

We estimate the quantity to be offered on our auction of 29th instant at about 2400 bales wool and mohair.

Mohair.—The demand for this article continues without change, competition remaining brisk.

Coarse and coloured is still in strong demand at full rates.

The following are prices current here to-day :—

NATAL AND EAST GRIQUALAND.

Midlands.

	d.		d.
Sorted clips, light and clean	10	to	12½
Unsorted clips, light and clean ..	9	„	10½
Bellies, pieces, etc.	5	„	7

Utrecht and Vryheid.

	d.		d.
12 months' sorted clips, light and clean	8½	to	9½
12 months' average clips, light and clean	7½	„	8
12 months heavy and faulty	6¼	„	6¾
6 to 9 months light and clean ...	6½	„	7
6 to 9 months heavy and faulty .	5½	„	6

Ladysmith, Newcastle, Dundee, etc.

	d.		d.
12 months' sorted clips, light and clean	9	to	10
12 months' average clips, light and clean	7¾	„	8¾
12 months heavy and faulty	6½	„	7
6 to 9 months light and clean ...	6½	„	7
6 to 9 months heavy and faulty .	5½	„	6¼

East Griqualand.

	d.		d.
12 months' sorted clips, light and clean	9	to	9½
12 months' average clips, light and clean	7½	„	8
12 months heavy and faulty	6¼	„	7
6 to 9 months light and clean ...	6½	„	7
6 to 9 months heavy and faulty ..	5	„	6

TRANSVAAL.

Volksrust, Wakkerstroom, Ermelo, Amersfoort, etc.	d.		d.
12 months' sorted clips, light and clean	9	to	10
12 months' average clips, light and clean	8	„	9
12 months heavy and faulty	7	„	7½
6 to 9 months light and clean	6½	„	7¼
6 to 9 months heavy and faulty	5½	„	6½

Standerton, Bethal, Middelburg, etc.	d.		d.
12 months' sorted clips, light and clean	8	„	9
12 months' average clips, light and clean	7	„	8

	d.		d.
12 months heavy and faulty	6¼	to	6¾
6 to 9 months light and clean	6	„	6¾
6 to 9 months heavy and faulty	5	„	6

Heidelberg, Pretoria, Potchefstroom, Klerksdorp, Lichtenburg, etc.	d.		d.
12 months' sorted clips, light and clean	7½	to	8½
12 months' average clips, light and clean	6½	„	7½
12 months heavy and faulty	6	„	6½
6 to 9 months light and clean	6	„	6¾
6 to 9 months heavy and faulty	5	„	5½

ORANGE FREE STATE.

Harrismith, Vrede, Bethlehem, Heilbron, etc.	d.		d.
12 months' sorted clips, light and clean	8	to	9½
12 months' average clips, light and clean	7¼	„	8¼
12 months heavy and faulty	6¾	„	7¼
6 to 9 months light and clean	6¼	„	7¼
6 to 9 months heavy and faulty	5½	„	6

Lindley, Kroonstad, Vredefort, Parys, etc.	d.		d.
12 months' sorted clips, light and clean	8	to	9
12 months' average clips, light and clean	7¼	„	7¾
12 months heavy and faulty	6¼	„	6¾
6 to 9 months light and clean	6	„	6¾
6 to 9 months heavy and faulty	5¼	„	6

Senekal, Ficksburg, Ladybrand, Winburg, etc.	d.		d.
12 months' sorted clips, light and clean	8	to	8¾
12 months' average clips, light and clean	7	„	7½
12 months heavy and faulty	6¼	„	6¾
6 to 9 months light and clean	6¼	„	7
6 to 9 months heavy and faulty	5	„	5¾

Coarse and Coloured.	d.		d.
Free from kemps	5	to	6¼
Ordinary	4	„	5
Inferior, kempy, and Persian	2	„	3½

BASUTOLAND AND NATIVE WOOLS.

	d.		d.
Superior lots, light and clean	6¼	to	7
Average lots	5½	„	6¼
Average lots, heavy and wasty	5	to	5½
Transkei, good	7	to	8
Transkei, ordinary	6	„	7

MOHAIR.

	d.		d.
Kids, good length and super quality	12	to	15
Long blue, super quality	10	„	11
Long blue, average	9	„	10
Good winter	8¼	to	9¼
Short and mixed winter	7½	„	8¼
Inferior and coloured	3	„	6

BASUTOLAND AND NATIVE MOHAIR.

	d.		d.
Good length and quality	9¼	to	10
Average lots	8¼	„	9¼
Inferior and short mixed	6	to	8

HIDES, SKINS, HORNS, ETC.

The market is very firm with a strong demand for all descriptions, at fully last week's prices :—

Hides.—Sundried, 14 to 20 lb. average, 10d. to 12d. per lb.; sundried, inferior, 8d. to 9d.; salted, 9d. to 10d.

Sheepskins.—Long-woolled, 5d. to 6d. per lb.; short-woolled, 3½d. to 4½d. Pelts, 1d. to 2½d.; coarse and coloured, 3d. to 5d.; salted, heavy, 4d. to 5¼d.

Goatskins.—Mixed parcels, sound, 4d. to 6½d. per lb.; inferior, 2d. to 3d.

Horns.—3d. to 12d. per pair.

Wattle Bark.—Market very dull, and prices have an easier tendency. Cut and bagged, good colour and quality, 4s. 6d. to 5s. per cwt.; cut and bagged, inferior colour and quality, 3s. 6d. to 4s. 6d.; uncut in bundles, good colour and quality, 3s. to 4s.; uncut in bundles, inferior colour and quality, 2s. to 3s.

Current Market Rates of Agricultural Produce and Stock.

The following TABLE OF CURRENT MARKET RATES OF AGRICULTURAL PRODUCE AND LIVE STOCK on Saturday, 1st February, 1913, ruling at the several Centres named, is published for general information.

Centre.	A. Wheat per 100 lb.	B. Wheat Flour per 100 lb.	C. Boer Meal per 100 lb.	D. Mielies per 100 lb.	E. Mielie Meal per 100 lb.	F. Barley per 100 lb.	G. Oats per 100 lb.	H. Oat-hay per 100 lb.	J. Lucerne Hay per 100 lb.	K. Potatoes per 100 lb.	L. Tobacco (Boer Roll) per lb.	M. Beef per lb.	N. Mutton per lb.	O. Fresh Butter per lb.	P. Eggs per dozen.	Q. Cattle (Slaughter).	R. Sheep (Slaughter).	S. Pigs.
Cape Province:	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	s. d.	£ s. d.
Aliwal North ...	11 6	23 6	30 0	20 0	22 6	15 0	16 6	7 6	6 0	25 0	1 0	0 8	0 6	1 3	1 9	12 10 0	18 0	*2 15 0
Beaufort West ...	12 6	17 9	13 6	10 6	10 6	9 0	8 3	4 6	5 0	14 0	1 0	0 6	†0 5½	1 9	1 6	13 0 0	13 0	5 0 0
Capetown ...	9 0	—	—	—	—	8 0	6 0	4 0	6 0	15 0	‡0 8	—	—	1 5	1 6	—	—	—
East London ...	9 6	18 6	30 0	6 6	18 6	5 0	6 6	5 0	6 0	15 0	1 0	0 4	0 5	1 3	0 10	15 0 0	20 0	1 10 0
Grahamstown ...	11 6	—	—	11 3	—	7 6	8 6	5 9	—	10 6	1 0½	0 5	0 5	2 3	1 1½	—	—	3 15 0
Kimberley ...	12 0	16 6	15 0	10 0	12 0	9 0	7 9	6 0	7 6	7 6	0 5	0 6	0 5	1 3	1 6	14 0 0	18 0	3½d.p.lb.
Kingwilliamstown	9 0	18 9	16 6	11 0	11 9	9 0	8 6	8 0	4 0	10 0	1 3	0 7	0 7	1 0	1 2	13 10 0	18 0	4d.p.lb.
Port Elizabeth ...	10 0	—	—	10 0	—	7 6	—	5 9	—	12 0	—	0 6	0 6	2 2	2 0	—	—	2 10 0
Queenstown ...	12 0	18 0	15 0	11 6	13 6	11 6	10 0	6 6	6 0	7 6	0 9	0 6	0 4	0 10	1 6	—	—	—
Natal:																		
Durban ...	—	—	—	—	—	—	—	—	4 6	11 0	—	—	—	1 3	2 4	—	—	—
Pietermaritzburg	10 9	11 11	—	—	—	12 3	8 3	6 9	5 0	9 0	0 4	0 5½	0 6	1 2	1 8	—	—	—
Transvaal:																		
Pretoria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Johannesburg ...	12 0	—	—	11 0	7 0	9 6	8 0	6 6	5 3	8 9	0 1	—	—	1 2	2 0	—	—	—
Orange Free State:																		
Bloemfontein ...	—	—	—	19 0	—	—	—	5 6	6 6	9 0	—	10 0	0 6	1 6	1 6	—	—	—
Harrismith ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Average, £2. 10s. to £3. † Average, 5d. to 6d. ‡ Average, 4d. to 1s.

Outbreaks of Animal Diseases.

THE following outbreaks of scheduled infectious and contagious animal diseases have occurred in the areas specified during the month ended 31st January, 1913.

C. E. GRAY,
Principal Veterinary Surgeon (Union).

CAPE PROVINCE PROPER.

(EXCLUDING TRANSKEIAN TERRITORIES.)

Anthrax.

District.	Area.	Number of Deaths.	Number of Contacts.
Albany	Grahamstown	2	10
Alexandria	The Post (Holthuizen)	2	30
"	Commonage	1	150
"	The Post (Van der Riet) ...	2	100
Komgha	Section 13/xiii/35	1	42
Mafeking	Farm Grootgewaagd	4	54
"	The Grange and Kameelbult ...	1	180

Glanders.

District.	Area.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.
Kingwilliamstown	C.M.R. Camp	1	29

East Coast Fever.

District.	Area.	Number of Animals Dead.	Number of Animals Sick.	Number of Animals in contact.
East London ...	Lot 13, Tower Hall, Ward VII	1	Unknown	Unknown at present.
" " ...	Lot 11, Celani, Ward VII	1	"	" "

Tuberculosis.

District.	Area.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Cape	Various	79	10	1
Malmesbury	„	18	Nil	Nil
Paarl	„	26	„	„
Stellenbosch	„	170	3	3

TRANSKEIAN TERRITORIES.

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Butterworth	Mabinzi and Zazine's Locations	—	—
Mquanduli	Msblaise's Location	—	—
Qumbu	Mnukwa's Location		—
Kentani	Xoxe's Location...		—
„	Sibozo's Location	5	236
Libodi	Valero's Location	—	—
Tabankulu	Vunmu's Location	1	303
„	Sigidi's Location	20	778
„	Njiva's Location	10	1019
„	Kentani's Location	26	2025
„	Mpongane's Location	—	—
Mount Ayliff	Laga's Location	4	84
Tsolo	Azimpi's Location	5	146
„	Fawkiti's Location	3	486
„	Ntunja's Location	4	605
„	Farm Fairview	—	—
Engcobo	Emjanjana Reserve		—
Umtata	Hollowmead	3	120
„	Melville Park	1	45
„	Mount Pleasant...	1	65
„	Edgehill	-	12
„	Thornridge		60
„	Springvale	1	—

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Kentani	Velbayi's Location	4	—
„	Dalveni's Location	9	—
„	Youngaga's Location	9	—
„	Mbanwana's Location	1	—
Butterworth	Waterdale	1	—

Mange in Equines.

District.	Name of Farm.	Number of Animals Affected.	Number of In-contacts.
Umtata	Umtata Town	5	Nil

NATAL.

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Alexandra Division	Guliga	6	7
Bergville Division	Rosenstein	—	—
Ixopo Division	Ellington	1	239
Krantzkop Division ...	Kaal Hoek	3	20
" " ...	Oliphant's Hoek		
Ladysmith Division ...	Onberkendt	—	—
Underberg Division	Hogback	3	13
Newcastle Division	Boscobello	1	120
Umvoti Division	Emandhleni	—	—

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Ixopo Division	Brooklyn...	3	—

Mange in Equines.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Ixopo Division	Lot 20, Gorton	—	3

Epizootic Lymphangitis.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Lower Umzimkulu	North Shepstone	1	None

Tuberculosis.

District.	Name of Farm.	Number of Animals Tested.	Number of Reactions and Destroyed.	Number of Doubtful Reactions to be Retested.
Pietermaritzburg	Mountain Rise	2	1	—
Estcourt Division	Hartford	22	2	1
		(Test	not yet comp	leted)
Durban Division ...	Umgeni	14	7	—

TRANSVAAL.

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Ermelo	De Goedehoop No. 26	1	300
Krugersdorp	Krugersdorp Station	1	17
„	Middelvlei No. 6	1	—
Potchefstroom	Co-operative Society, Potchefstroom	1	—
„	Wilgeboom No. 588	3	18
Waterberg	Volspruit No. 2041	4	223
Potchefstroom	Kooikraal No. 678	1	—
„	Welgevonden No. 560	2	—

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Piet Retief	Annyspruit No. 144	1	290

Glanders.

District.	Name of Farm.	Clinically Affected and Destroyed.	Reacted to Test and Destroyed.	Number of In-contacts Tested.
Krugersdorp ...	Krugersdorp Town ...	1	1	13
" ...	" " ...	1	—	23

Tuberculosis.

District.	Name of Farm.	Number of Animals Tested.	Number of Reactions to Test and Destroyed.	Number of Doubtful Reactions to be Retested.
Witwatersrand ...	Regent's Park	3	2	—
" ...	Mooifontein No. 14 ...	16	—	2
Krugersdorp ...	Roodepoort	1	—	1

ORANGE FREE STATE.

Glanders.

District.	Name of Farm.	Clinically Affected and Destroyed.	Reacted to Test and Destroyed.	Number of In-contacts Tested.
Harrismith ..	King's Hill	—	4	700

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Kroonstad	Corporation Farm	5	290

Tuberculosis.

District.	Name of Farm.	Number of Animals Tested.	Number of Reactions to Test and Destroyed.	Number of Doubtful Reactions to be Retested.
Thaba 'Nchu ...	Government Farm, Twee-spruit	126	1	—
" ...	" " "	3 pigs	1	—

Farm Employment.

Englishman, aged 60, with farming experience in England and eighteen years' experience in South Africa, desires employment on farm in capacity of manager or otherwise. Is thoroughly acquainted with and proficient in dairying and stock farming and the raising of crops of all kinds. Thoroughly understands the working of lands, pruning, laying out of farms, etc. Is in addition a first-class accountant. Terms to be arranged.—J. H. V. MICHELL, 118 Bree Street, Capetown. [11]

Applicant, aged 28, is anxious to obtain employment on a farm at terms to be arranged. Has spent most of his life in farming in this country, and is specially interested in farm machinery and the manipulation thereof, of which he has a good knowledge. Married. Dutch-speaking, and possesses a slight knowledge of English.—G. L. EHLERS, Berg Rivier Mond, via Vredehoek, Malmesbury. [12]

Employment is desired by manager, 39, on tobacco or fruit farm. Experienced in tobacco growing and general farming.—C. A. FAIRLIE, 46 Esselen Street, Johannesburg. [12]

Management of farm wanted by thoroughly experienced young man. Thorough knowledge of ostriches and lucerne growing.—C. SCHEEPERS, Post Restante, Jeppe. [12]

A healthy, steady young man of 22 years of age, unmarried, desires situation on a farm. Born in South Africa. Thoroughly acquainted with general farming business. Not afraid to do work of any kind on a farm.—H. R. WATKINS, Smalpoort, P.O. Ida, Elliot, C.P. [1]

Applicant, 21 years of age, with knowledge of simple book-keeping, desires employment on a farm. No experience of South African farming, but is willing to learn.—ALEXANDER SIDDENS, P.O. Box 691, Capetown. [1]

Employment on farm is sought by a young German, 26 years of age. Married (but wife would not accompany him on farm). Has had good experience of farming, and horse and cattle breeding. Three years on intensive farms in Germany as manager, and can show good testimonials. Good education. Speaks English and Dutch.—FRITZ BAUM, Friederichsruh, P.O. Ida, via Indwe, C.P. [1]

Applicant, age 29, single, steady, desires to obtain situation on farm anywhere in the Union of South Africa. Accustomed to working with horses and oxen; understands all kinds of farming—agricultural and stock—and all up-to-date dairy work, calf rearing and feeding. Has had nine years' experience in South Africa.—H. H. WILLEY, South Coast Junction, Durban, Natal. [1]

Young man of good education, age 17, desires position on farm as learner. Natal Province preferred.—H. A. F., Box 274, Maritzburg, Natal. [1]

Applicant, age 28, single, with some experience of agriculture, desires situation for purpose of gaining experience of general farming (crops and live stock). Speaks English, Dutch, and Kaffir.—W. M. BAKER, 230 Visagie Street, Pretoria. [2]

Situation desired as farm manager.—P. S. CAMPBELL, Fort Beaufort. [2]

Opportunity for European lad, about 17 or 18 years of age, to learn farming, with special reference to tobacco, lucerne, ostrich, sheep and cattle farming, dairy farming.—J. C. RAUBENHEIMER, Seymour, C.P. [2]

Advertiser, with Free State and Rhodesian experience, desires post as manager, on salary or share basis. Preferably would like to meet man with capital and farm, who would go in for trees and side lines.—F. R. C. I., c/o *Agricultural Journal* Office. [2]

Agricultural Show Dates, 1913.

Secretaries of Societies which propose holding shows during 1913, the dates of which do not appear in the following list, are invited to send particulars at the earliest opportunity.

Cape Province.

Queenstown, 19th and 20th February.
Ceres, 20th February.
Beaufort West, 20th and 21st February.
Malmesbury, 21st February.
Rosebank, 25th to 28th February.
Cathcart, 26th February.
Graaff-Reinet, 4th and 5th March.
Middelburg, 6th to 8th March.
Cradock, 11th and 12th March.
Bathurst, 12th and 13th March.
Molteno, 12th and 13th March.
Oudtshoorn, 12th and 13th March.
Somerset East, 14th and 15th March.
Aliwal North, 14th and 15th March.
Barkly East, 19th and 20th March.
Humansdorp, 19th and 20th March.
Grahamstown, 26th and 27th March.
Port Elizabeth, 1st to 4th April.
Kimberley, 8th to 10th April.

Transvaal.

Amersfoort, 26th and 27th February.
Ermelo, 19th February.
Bethal, 5th March.
Middelburg, 5th March.
Leslie, 10th (?) March.
Volksrust, 12th and 13th March.
Carolina, 19th March.
Standerton, 19th and 20th March.
Wakkerstroom, 20th March.
Johannesburg, 26th to 29th March.
Potchefstroom, 16th and 17th April.
Heidleberg, 23rd and 24th April.
Klerksdorp, 14th May.
Pretoria, 22nd to 24th May.
Rustenburg, 30th and 31st May.
Waterberg, 20th May.
Wolmaransstad, 4th and 5th June.
Barberton, 4th July.
Klerksdorp.—No show owing to drought.

Natal.

Vryheid, 6th and 7th June.
Umvoti, 20th and 21st June.
Alexandra, 24th June.
Pietermaritzburg, 25th to 27th June.
Durban, 2nd to 4th July (provisional dates).
Stanger, 9th July.
New Hanover, 10th July.
Richmond, 25th July.

Orange Free State.

Kroonstad, 26th and 27th February.
Marquard and Clocolan, 26th and 27th February.
Rouxville, 26th and 27th February.
Ficksburg, 4th and 5th March.
Lindley, 4th and 5th March.
Thaba 'Nchu, 4th and 5th March.
Bethulie, 5th and 6th March.
Jagersfontein, 11th and 12th March
Senekal, 11th and 12th March.
Vrede, 12th and 13th March.
Wepener, 12th and 13th March
Fauresmith, 18th and 19th March.
Boshoff, 19th and 20th March.
Smithfield, 18th and 19th March.
Bethlehem, 19th and 20th March.
Edenburg, 25th and 26th March.
Hoopstad, 26th and 27th March.
Harrismith, 1st and 2nd April.
Heilbron, 2nd and 3rd April.
Winburg, 9th and 10th April.
Bloemfontein, 15th to 17th April.
Ladybrand.—No show will be held, owing to drought.

Departmental Notices.

TOBACCO SEED.

The Tobacco and Cotton Division will have a quantity of selected and acclimatized tobacco seed of heavy and bright types for distribution about June, 1913. All applications for seed must reach the Chief of the Tobacco and Cotton Division, P.O. Box 516, Pretoria, not later than 1st May, 1913.

This seed will be distributed pro ratio at a charge of 1s. per oz. Each applicant will be informed soon after the 1st May what quantity can be supplied and the seed will be dispatched so soon as the cash is remitted.

Turkish Tobacco Seed: The following varieties of Turkish seed can be obtained from the Officer in Charge of Turkish Tobacco Experiments, La Motte, Paarl, Cape Province, at the prices quoted, viz.:—

Soulook	4s. per oz.
Malcadje	4s. „
Baladovari	4s. „
Dubeck	5s. „

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

CLEANING AND GRADING TOBACCO SEED.

The Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, are prepared to clean and grade tobacco seed sent to them by farmers free of charge.

The process separates the light from the heavy seed, and the result is that a much larger percentage of the cleaned seed will germinate.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

COTTON SEED.

Selected seed of several varieties of American Upland Cotton can be obtained from the Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, at a charge of 3d. per lb.

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

VETERINARY RESEARCH LABORATORY, ONDERSTEPOORT.

Admission of Visitors.

It is hereby notified for the information of the public that visitors cannot be admitted to the Veterinary Research Laboratory at Onderstepoort during working hours on weekdays unless a special permit has previously been obtained from the Secretary for Agriculture.

The most convenient time for visitors to be shown over the Laboratory is Sunday afternoon, when an officer will be specially detailed for the purpose and permits will not be required.

EXPERIMENTAL FARM, POTCHEFSTROOM.

Seeds for Disposal.

Wheat.—Price 12s. 6d. per 100 lb. delivered at buyers' station. This price is subject to alteration without notice.

Early and Medium Early Varieties suitable for Irrigated Land.—Wit Klein Koren; Rooi Wol Koren; Spring; Glujas Early; Eckstein; Bombay; Fourie; Australian (Early); Hawkesbury; Egyptian Red.

These seeds consist of different varieties which have been experimented upon at this Farm, and have proved valuable; the crops thereof have been specially grown for seed purposes.

Application for these seeds should be made on or before the 15th March. No orders will be booked until that date, but applications may then be closed, and the available supply distributed pro rata among the different applicants. In that case only orders which have been then definitely placed will be considered; an inquiry which is still the subject of correspondence will not be considered a definite order. These "seeds" will not be forwarded on the c.o.d. system.

Orders must be accompanied by remittance, and cheques and money orders should be drawn in favour of the Principal, Experimental Farm, Potchefstroom, from whom any further particulars may be obtained.

H. THOMPSON,
for *Principal.*

27th January, 1913.

FOWLS FOR SALE AT GROOTVLEI EXPERIMENT STATION. ORANGE FREE STATE.

A number of cockerels and pullets of the following breeds are ready for sale from the Grootvlei Experiment Station:

White Leghorns. White and Silver Wyandottes. Plymouth Rocks.

Applications should be addressed to the Poultry Manager, Grootvlei, P.O. Bloemfontein

PIGS FOR SALE.

Large white Yorkshire and Berkshire Pigs are for sale from the Tweespruit Stud Farm, P.O. Tweespruit, and large Blacks and Berkshires from the Roodepoort Stud Farm, P.O. Dewetsdorp. Inquiries should be addressed to the Managers of the farms mentioned.

ORGANIZATION OF DEPARTMENT OF AGRICULTURE.

Administrative Office ... ... Pretoria.
Telegraph Address ... ... "Landbouw, Pretoria."

Secretary for Agriculture: F. B. Smith. Under-Secretaries for Agriculture: P. J. du Toit and A. Holm. Deputy-Accounting Officer: J. Collie. Chief Clerk. G. N. Williams. Officer in Charge of Inquiry Office, Capetown: G. W. Klerck.

VETERINARY DIVISION.

This Division endeavours to prevent the introduction of contagious diseases of live stock into the Union and to eradicate such as are already present, and to protect live stock against enzootic diseases by inoculation and other means. So far as it is able to do so without interfering with its other duties, the Division advises and assists farmers upon diseases of stock generally and endeavours to enlighten them upon veterinary hygiene and the care of live stock. For veterinary purposes the Union is divided into five areas, each in charge of Senior Veterinary Officers, who are responsible for the control of disease within these areas.

Principal Veterinary Officer: C. E. Gray. Assistant Principal Veterinary Officer: J. D. Borthwick.

Cape Province.—Senior Veterinary Officer: R. W. Dixon, Government Offices, Parliament Street, Capetown. Government Veterinary Officers: C. S. Elphick, Vryburg; E. Fern, Capetown; A. Matthews, Capetown: G. W. Freer, Uitenhage; R. I. Jones, East London; J. H. L. Lyons, East London; J. Nichol, Kingwilliamstown; W. G. Pakeman, Queenstown; and W. A. Simson, Cradock.

Transvaal.—Senior Veterinary Officer: J. M. Christy, Department of Agriculture, Pretoria. Government Veterinary Officers: R. S. Garraway, Pretoria; W. G. Evans, Volksrust; P. Conacher, Johannesburg; J. G. Bush, Krugersdorp; T. H. Dale, Potchefstroom; H. M. Webb, Zeerust; J. M. Tate, Rustenburg; J. Chalmers, Nylstroom; J. I. Edgar, Pietersburg; G. Lee, Lydenburg; G. C. Webster, Barberton; D. B. J. McCall, Ermelo; and G. May, Standerton.

Natal.—Senior Veterinary Surgeon: W. M. Power, Colonial Buildings, Pietermaritzburg. Government Veterinary Surgeons: S. H. Ewing, Eshowe; A. F. Harber, Point, Durban; S. I. Johnston, Maritzburg; F. J. Hill, Bulwer; A. Goule, Maritzburg; J. L. Webb, Mooi River; C. Tyler, Ladysmith; and F. Hutchinson, Dundee.

Orange Free State.—Senior Veterinary Surgeon: A. Grist, Government Buildings, Bloemfontein. Government Veterinary Surgeons: J. F. Joyce, Ficksburg; J. A. A. Hamilton, Kroonstad; F. M. Skues, Bethlehem; C. H. Wadlow, Smithfield; and C. T. Clemow, Frankfort.

Transkeian Territories.—Senior Veterinary Officer: J. Spreull, Umtata. Government Veterinary Surgeons: A. C. Kirkpatrick, A. M. Howie, T. M. Doyle, W. A. Dykins, A. Goodall, G. T. Henerson, and J. A. Worsley.

DIVISION OF VETERINARY RESEARCH.

The duty of this Division is the investigation of diseases of live stock with a view to discovering methods of eradicating them or of protecting animals against them. It examines and reports upon pathological specimens forwarded by the Veterinary Division and farmers and prepares vaccines and sera of various kinds, and also mallein, tuberculin, and other diagnostic and preventive agents.

Opportunities are offered to post-graduate students for the carrying out of specia investigations and a great deal of educational work is performed by the Division.

The Division is in close touch with and is complementary to the Veterinary Division. Director of Veterinary Research: Dr. A. Theiler. Assistant Director of Veterinary Research: W. Robertson. Superintendent: E. Parkes. Professional Assistants: D. T. Mitchell W. H. Andrews, D. Kehoe, F. Veglia, W. Jowett, G. N. Hall, G. A. H. Bedford, A. W. Shilston (Pietermaritzburg), and J. Walker (Grahamstown).

DIVISION OF SHEEP.

This office is charged with:—(*a*) Eradication of scab; (*b*) improvement of pastora industries; (*c*) the management of the Stud Sheep Farm at Ermelo; (*d*) the improvement of the flocks maintained on the various Experimental Farms; and (*e*) the control of the Field Cornets in the Transvaal Province.

Chief of Division: B. G. L. Enslin. Principal Sheep Inspector: A. G. Davison. Principal Sheep and Wool Expert: Charles Mallinson.

For the better carrying out of the work in connection with scab, the Union is divided into twenty-four areas in charge of Senior Sheep Inspectors; these areas are in turn divided into 297 inspection districts, each in charge of an Inspector. In addition there are ten Inspectors employed on the railway lines for the prevention of the movement of infected stock by rail. There are also five whole-time Inspectors employed on certain large commonages.

A similar organization is adopted in respect of the improvement of sheep and wool.

Orange Free State Province.—Sheep and Wool Expert: J. F. McNab, Bloemfontein. Assistant Sheep and Wool Expert: A. V. M. Suter, Bloemfontein.

Cape Province.—Sheep and Wool Expert: W. M. McKee, Queenstown. Assistant Sheep and Wool Experts: E. V. Goddefroy, Worcester; P. S. Taylor, Steynsburg.

Transvaal Province.—Western District Assistant Sheep and Wool Expert: A. M. Spies, Headquarters not yet fixed. Eastern District Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal.

Natal Province.—Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal. This area includes the East Griqualand District of the Cape Province.

Manager, Ermelo Stud Sheep Farm: A. G. Michaelian.

DIVISION OF ENTOMOLOGY.

This Division obtains and disseminates information relative to beneficial and injurious "insects." In collaboration with the Division of Plant Pathology, it administers the law relating to the introduction of plants into the Union and by the inspection of nurseries and other methods, it endeavours to control injurious "insects" present in the Union; it is also responsible for the destruction of locusts.

Chief of Division: C. P. Lounsbury. Entomologists: Claude Fuller and C. P. v. d. Merwe, Pretoria; C. W. Malley, Capetown; .... Bloemfontein; and C. B. Hardenberg, New Hanover, Natal (investigating wattle insects).

DIVISION OF BOTANY.

This Division is concerned with the investigation of the merits of indigenous plants of economic importance and of poisonous plants and noxious weeds, the identification of plants, the introduction and testing of economic plants from abroad and the improvement of farm crops by breeding.

Chief of Division: J. Burtt-Davy. Herbarium Assistant: Miss C. Stent.

DIVISION OF PLANT PATHOLOGY AND MYCOLOGY.

This Division in engaged in the investigation and control of diseases of plants, produced by fungous and physiological causes, and the study and collection of fungi of economic importance.

Chief of Division: I. Pole Evans. Professional Assistants: Miss E. M. Doidge and P. v. d. Byl.

DIVISION OF TOBACCO AND COTTON.

The object of this Division is the promotion of the tobacco and cotton industries. Experiments are conducted in the breeding and growth of tobacco and cotton and in the curing, fermentation, and preparation of tobacco for the market. Approved varieties of tobacco and cotton seed are distributed amongst farmers and advice given to them personally and by correspondence and publications.

Chief of Division: W. M. Scherffius. Tobacco Warehouse Expert: T. E. Elgin. Expert for Turkish tobacco, Western Province, Cape: L. M. Stella, "La Motte," Paarl. Manager, Experiment Station, Rustenburg: H. W. Taylor. Manager, Experiment Station, Barberton: W. B. Wilson. Manager, Tzaneen Estate: E. H. F. Powell. Manager, Experiment Station, Piet Retief: R. Falgate. Manager, Cotton Experiment Station, East London: D. D. Brown.

DIVISION OF DAIRYING.

This Division deals with all matters connected with the advancement of dairying. The Division also controls the Cold Stores at Vryburg.

Superintendent of Dairying: E. O. Challis. Senior Inspector:................ .... Instructors: *Cape Province.*—T. R. Carruthers, Government Offices, Parliament Street, Capetown, and C. Schmolke, Queenstown. *Orange Free State.*—W. Oosterlaak, Government Buildings, Bloemfontein. *Natal.*—.............................., Colonial Office, Pietermaritzburg. *Transvaal.*—L. J. Veenstra, Department of Agriculture, Pretoria.

DIVISION OF HORTICULTURE.

This Division advises farmers on the growing and marketing of fruit, including table grapes and raisin drying, and grades fruit for export.

Chief of Division: R. A. Davis. Horticulturist in charge of Experiment Station, Warmbaths: C. A. Simmonds. Horticulturist in charge of Experiment Station, Ermelo: R. le Sueur. Instructor in Horticulture, Cape Province: S. W. van Niekerk, Bovenvallei, Wellington.

DIVISION OF VITICULTURE.

This Division is charged with the duty of advising farmers in all matters relating to the culture of the vine (excluding table grapes and raisin-making) and the manufacture of wine and brandy, and vinegar. It conducts field investigations into the suitability of various stocks, the use of fertilizers, modes of cultivation, etc., and investigates the diseases of the vine, and conducts both cellar and laboratory experiments in the making of wine and brandy. It examines pathological specimens and furnishes reports thereon, and examines chemically and bacteriologically specimens of the products above mentioned with a view to furnishing advice thereon to farmers.

This Division also includes the Government Wine Farm, Groot Constantia, where advice can be obtained by residents in the Wynberg and Hout Bay areas.

Government Viticulturist: A. J. Perold, Œnological Station, Paarl, Cape Province. Manager, Government Wine Farm, Groot Constantia: T. L. Watermeyer.

OFFICE OF GUANO ISLANDS.

This office undertakes the conservation, collection, shipment, and sale to the public of the guano, seal skins, etc., obtained on the various islands belonging to the Union, and is charged with the administration of all matters connected therewith.

Superintendent: W. R. R. Zeederberg, 69 Strand Street, Capetown.

DIVISION OF CO-OPERATION.

This Division is engaged in promoting co-operation for the sale and purchase of agricultural products and necessities amongst farmers and in organizing and supervising co-operative societies.

Superintendent: C. H. Keet. Chief Inspector: J. Retief. Assistant Inspectors: J. T. Taylor and H. Minnaar.

DIVISION OF CHEMISTRY.

This Division investigates problems of general or special importance, and for the present undertakes the analysis of soils, manures, and foodstuffs for farmers in the Transvaal, the analysis of similar matters in the other Provinces being undertaken in the laboratories of the Department of the Interior at Capetown, Grahamstown, Maritzburg, and Bloemfontein, pending the enlargement of the chemical laboratories at the agricultural schools and experiment stations.

The analyses are conducted solely for the enlightenment of the farmers and not for legal purposes.

Chemist: H. J. Vipond. Laboratory Assistant: L. Bischoff.

DIVISION OF FENCING AND BRANDS.

This Division administers the laws relating to fencing and brands, and publishes the Brands Directory, required by the Transvaal Act.

Controller of Fencing and Registrar of Brands: W. J. Nussey.

OFFICE OF HOUSEHOLD SCIENCE.

The duties of this office are to promote the study of household science by means of lectures, demonstrations, and correspondence.

Lecturer and Instructor: Miss J. C. van Duyn.

DIVISION OF DRY-LAND FARMING.

This Division conducts experiments and disseminates information on dry-land farming. An Experiment Station is maintained at Lichtenburg, with subsidiary ones at Pretoria, Warmbaths, and Pietersburg. Experiments in dry-farming are also conducted at the agricultural schools and experiment stations, and at other centres.

Dry-land Agronomist and Manager, Experiment Station, Lichtenburg: H. S. du Toit.

DIVISION OF GRAIN INSPECTION.

This Division undertakes the grading of grain at the ports prior to export, and, if requested to do so, determines the amount of moisture present in grain intended for export.

Chief Inspector of Grain: G. F. Nussey. Government graders are stationed at the docks at Capetown, Port Elizabeth, East London, and Durban.

DIVISION OF PUBLICATIONS

This Division edits the *Agricultural Journal* and other departmental publications.

Editor: Dr. W. Macdonald.

LIBRARY.

The object of the Library is to provide as complete a collection of agricultural literature as possible for the purpose of reference.

Librarian: P. Ribbink.

AGRICULTURAL SCHOOLS AND EXPERIMENT STATIONS.

The duties of these institutions are to provide complete courses of education extending over a period of two years and shorter courses of a technical character for persons actually engaged in farming, to instruct farmers in the area served by them on matters relating to the various phases of farming by means of personal visits, lectures, demonstrations, and correspondence. To conduct experiments, to analyse soils, manures, dairy products, etc., and to identify plants and insects and test seeds. A certain amount of pure-bred stock and of new and approved varieties of seeds are produced on the farms and disposed of to the public.

The institutions do not undertake the administration of laws relating to agriculture.

Elsenburg School of Agriculture and Experiment Station.—Station: Mulder's Vlei; distance, 1½ miles.

Sub-stations at Malmesbury and Robertson.

Principal...	Dr. A. I. Perold.
Lecturer in Veterinary Science	R. Paine.
„ Horticulture	L. Tribolet.
„ Chemistry ...	D. C. Crawford.
„ Engineering	W. H. Chandler.
„ Botany and Plant Breeding	J. H. Neethling.
„ Dairying ...	J. Gow.
„ Agriculture	F. Fowlie.
Farm Manager ...	Vacant.
Agricultural Assistant ...	C. L. R. de Wet, George.

Grootfontein School of Agriculture and Experiment Station.—Station: Middelburg, Cape Province; distance, 2 miles.

Principal...	R. W. Thornton.
Lecturer in Agriculture	G. J. Bosman.
„ Veterinary Science	J. A. Robinson.
„ Engineering	E. A. Morris.
„ Chemistry ...	W. R. S. Ladell.
„ Zoology and Entomology...	R. O. Wahl.
„ Dairying ...	J. Anderson.
„ Sheep and Goats ...	E. N. C. Warren.
„ Poultry ...	A. Little.
„ Farm Manager ...	Van der Merwe.

Agricultural Assistants: J. Meldal Johnson, Humansdorp; A. K. Hards, Cathcart; W. J. Lamont, Grootfontein; and Mr. Melle, Vryburg.

Potchefstroom School of Agriculture and Experiment Station.—Station: Potchefstroom; distance, 1½ miles.

Principal...	E. J. Macmillan.
Vice-Principal	H. Thompson.
Lecturer in Chemistry	T. G. Reinecke.
„ Botany	T. O. Bell.
„ Zoology and Entomology	W. Moore.
„ Veterinary Science	J. R. Quinlan.
„ Engineering	W. S. H. Cleghorne.
„ Poultry	R. Bourlay.
„ Horticulture	W. Sturm.
„ Dairying	J. B. Fisher.
„ Agriculture	A. M. Bosman.
Farm Manager	Alex. Reid.

Cedara School of Agriculture and Experiment Station.—Station: Cedara, on farm; sub-station at Winklespruit.

Principal...	E. Harrison.
Lecturer in Chemistry	C. Williams.
„ Biology	J. Fisher.
„ Veterinary Science	F. J. Curless.
„ Dairying and Poultry	A. Lawrence.
„ Horticulture	C. R. Parsons.
Farm Manager	W. C. Mitchell.

STUD FARMS.

At these farms pure-bred animals, mainly horses, are maintained and bred for lease and sale to farmers.

Standerton Stud Farm.—Station: Standerton; distance, 11 miles. General Manager: A. McNae.

Tweespruit Stud Farm.—Station: Tweespruit, on farm. Manager: J. J. Morton.

GOVERNMENT WINE FARM, GROOT CONSTANTIA.

VISITORS' DAYS.

It is notified by the Secretary for Agriculture that it has been decided that persons shall be allowed to visit the Government Wine Farm at Groot Constantia between the hours of 9 a.m. and 5 p.m. on Mondays, Tuesdays, and Thursdays.

Importation of Live Stock.

RETURN showing particulars of certain Pure-Bred Live Stock recently imported into the Union of South Africa.

Stud-Book No. or Name.	Breed and Stud-Book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
HORSES:				
"Malpas"	No particulars ...	Stallion	United Kingdom	H. F. Seale, Kenilworth, C.P. (24/12/12).
"Morston Flash," No. 3964	Suffolk; S'ff'lk Horse Soc. Stud-Bk., vol. 18	„	„	F. R. Thompson, Ascot, Kenilworth, C.P. (10/1/13).
"Morston Saunterer," No. 4058	„ „	„	„	„ „
"King's Champion"	English Stud-Book, vol. 21, p. 706	„	„	F. M. Williamson, Wynberg (10/1/13).
"Lilac of Woodlands," No. 31958	Clydesdale; Clydesdale Horse Soc. of Gt. Britain & Ireland	Mare	England	Livingstone Moffat, Tarkastad (13/1/13).
"Garroch Lady," No. 31957	„ „	„	„	„ „
"Buckie Belle," No. 31959	„ „	„	„	„ „
"Nell of Castlecrearie," No. 26280	„ „	„	„	„ „

Export of South African Graded Maize, 1912.

Grades.	Transvaal.	Free State.	Natal Province.	Cape Province.	Totals.
	Bags.	Bags.	Bags.	Bags.	Bags.
F. W. 1	3,786	7,095	26,473	- -	37,354
2	354,508	134,431	34,152	140	523,231
3	5,082	21,762	100	—	26.944
F. Y. 4	47,807	13,328	2,304	—	63.439
R. W. 5	249	611	—	—	860
R. Y. 6	30,038	139,529	925	—	170,492
F. M. 7	283	257	—	—	540
R. M. 8	400	6,100	—	—	6,500
B. G. 9	2.504	878	—	—	3,382
1912 Totals	411,657	323,991	63.951	140	832,742
1911 Totals	652,254	314,731	41,566	7,892	1,016,443

Grade.	Durban.	Capetown.	Algoa Bay.	East London.	Totals.
	Bags.	Bags.	Bags.	Bags.	Bags.
F. W. 1	33,167	4,187	....	—	37,354
2	377.013	127.293	12,626	6,299	523,231
3	21,519	2,425	—		26,944
F. Y. 4	15,181	42,730	5,476	52	63,439
R. W. 5	667	193	—	—	860
R. Y. 6	46,119	104,094	10,601	9,678	170,492
F. M. 7	162	326	51	1	540
R. M. 8	4,431	314	1,755		6,500
B. G. 9	3,044	336	—	2	3,382
1912 Totals	504,303	281,898	30,509	16,032	832,742
1911 Totals	460,671	297,869	202,497	55,406	1,016,443

Codling Moth Regulations.

ANNEXURE A.

The Public is advised that the area of the Cape Province into which the removal of apples, pears, and quinces is forbidden, has been materially modified by Proclamation No. 20 of 1913 published in the *Government Gazette* for 7th February. The restrictions now apply only to (1) the Districts of Alexandria, Peddie, and Bathurst, and (2) the Districts of Barkly East, Komgha, and the Transkeian Territories. The only sections of railway in the Cape Province for which traffic in the fruits named cannot now be accepted are the Alexandria Branch, Butterworth Branch, Kowie Line, and Sterkstroom–Maclear Branch beyond Indwe. The closed areas of the Northern Provinces have not been altered.

Notes in explanation of the regulations and specifying what sections of railway are now in the several protected areas, will be published in the next issue of the *Agricultural Journal.*

The Agricultural Journal

OF THE UNION OF SOUTH AFRICA.

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Telegraphic Address: "Bulletin, Pretoria."

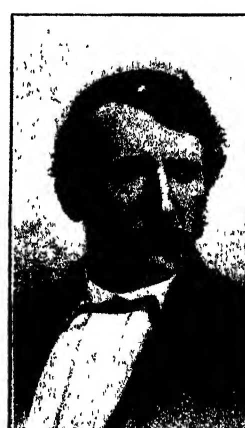
Advertising inquiries should be addressed to the Metropolitan Advertising Co., Box 962, Capetown.

Editorial Notes.

"I beg to direct your attention to Africa. I know that in a few years I shall be cut off in that country which is now open. Do not let it be shut again. I go back to Africa to try to make an open path for commerce and Christianity. Do you carry out the work which I have begun. I leave it with you." —LIVINGSTONE.

The Livingstone Centenary.

On 19th March there will be celebrated in all parts of the British Empire the centenary of the birth of David Livingstone. And the question naturally arises: How are the people of South Africa going to commemorate this notable event? In his book on "Livingstone and Central Africa," Sir Harry Johnston, in speaking of the spot where the explorer's heart lies buried, says that in the gold rush of the future on the shores of Lake Bangweolo, the local inhabitants will probably be too busy and too mean to spend money on monuments to his memory. We do not believe this to be true of South Africans. But is there a solitary statue to the immortal traveller in the whole of the Union? And if not, why not? Livingstone belongs to the whole nation. To the Dutchman he must ever appeal as the grandest Voortrekker that has been; while the Englishman can never forget that those lion-mangled bones were fitly laid to rest amid the pomp of a mourning Empire in the peace of the hallowed Abbey. The last time we crossed the American continent we stood before a splendid monument in the main square of Salt Lake City. On it was inscribed the thrilling



DAVID LIVINGSTONE.
(1813–1873.)

line: "To Brigham Young and the Pioneers." How much nobler was the life-work of Livingstone! Why should not we write on our statue—

To
David Livingstone
and
The Voortrekkers.

He must look towards the Great North. And on granite should be carved in gold his prophetic words—

"*The end of the geographical feat is only the beginning of the enterprise.*"

His Life-dream.

The father of David Livingstone was a small tea dealer, who died in the year 1856 while his illustrious son was travelling homewards from Zumbo on the Zambezi. Of his mother his earliest recollection was an anxious housewife striving to make both ends meet. Yet on their tombstone in the cemetery of Hamilton he thanked God "For poor and pious parents." The story of the child in the cotton factory at the age of ten and his quenchless thirst for learning, is well told in the opening pages of the "Missionary Travels." Having qualified in due course as a medical missionary, Dr. Livingstone embarked in the year 1840, and after a voyage of three months reached the Cape. From thence he proceeded to Algoa Bay, and a little later trekked inland to the Kuruman Mission Station in Bechuanaland. From here he started on his memorable journeys to Lake Ngami, the Zambezi, Loanda, and Quilimane. When Livingstone stated his determination to go north, Sechele, the Chief of the Bakwains, who lived at Shokuane, pointed to the great Kalahari Desert and replied: "You can never cross that country to the tribes beyond. It is utterly impossible even for us black men, except in certain seasons, when more than the usual supply of rain falls and an extraordinary growth of water-melons follows." We have no space to speak of Livingstone's explorations in the "Great Thirst Land," but the following note on the climate of the surrounding region, written sixty-two years ago, is of special interest:—

"The whole of the country adjacent to the desert, from Kuruman to Kolobeng, Litubarubam and beyond, up to the latitude of Lake Ngami, is remarkable for the salubrity of its climate. Europeans whose constitutions have been impaired by an Indian residence feel its restorative powers. Mr. Oswell thought the climate much superior to that of Peru, and were it not for the great expense of such a trip, I should have no hesitation in recommending the borders of the Kalahari Desert as admirably suited for pulmonary complaints. It is the complete antipodes of our raw English atmosphere. The winter, which begins in May and ends in August, is perfectly dry. Not a drop of rain falls during that period, and damp and cold are never combined. During many months there is scarcely any dew. However hot the day might have been at Kolobeng—and the thermometer sometimes rose to ninety-six degrees in the coolest part of our house—yet the atmosphere never had that steamy feeling and

those debilitating effects which prevail in India and on the coast of Africa itself. Nothing can exceed the balminess of the evenings and mornings throughout the year. You wish for an increase neither of cold nor heat."

Livingstone was firmly convinced of the great value of emigration to the individual as well as to the Empire at large, and to plant British colonies in Africa became one of his master ideas and favourite schemes. In one of his letters he advises his own family to emigrate. He sent home £10 to aid this scheme of emigration, and £10 to be spent on clothes for himself. A little later we find that he wishes to add the second sum to the first so that his help might be more substantial, and he would make his old clothes serve for another year. In a subsequent letter, dated 4th December, 1850, he writes: "If I could only be with you for a week, you would soon be pushing on in the world. The world is ours. Our Father made it to be inhabited, and many shall run to and fro and knowledge shall be increased. *It will be increased more by emigration than by missionaries.*"

Again, on 4th August, 1859, he writes in his journal: "I have a very strong desire to commence a system of colonization of the honest poor. I would give £2000 or £3000 for the purpose." Livingstone longed to develop, by means of an industrious peasantry, those regions which he had discovered. He died without being able to put his ideas into practice. Surely we in South Africa, in peace and comfort, might spare a little of our vast wealth to carry forward his life-dream.

Founders of the Fruit Industry.

If you leave Capetown by the 8.7 train in the morning, you will arrive at Paarl soon after 10 o'clock. Here a wait of almost one hour will allow you to visit the glistening pearl-like granite boulders from which the town takes its name. At Paarl Station you then cross over the main track to the branch line for French Hoek, and after passing two sidings on the sand flats you presently arrive at Groot Drakenstein—the home of the Rhodes Fruit Farms and the Pickstone Estates. The former is now managed by a company, whilst the latter is a private concern; but both lie side by side synonymous of the friendship of the founders of the South African fruit industry—Rhodes and Pickstone. The immortal work of the one is too well known to our readers to need any further mention, and although every fruit farmer has heard of the name of the other, not all are acquainted with his curious and interesting career. Such we shall now relate as we heard it in his cool and pleasant homestead, half-hidden by stately trees, a stone's-throw from the green-gold fruit, and circled by the towering, purple-tinted sierras.

CECIL JOHN RHODES.

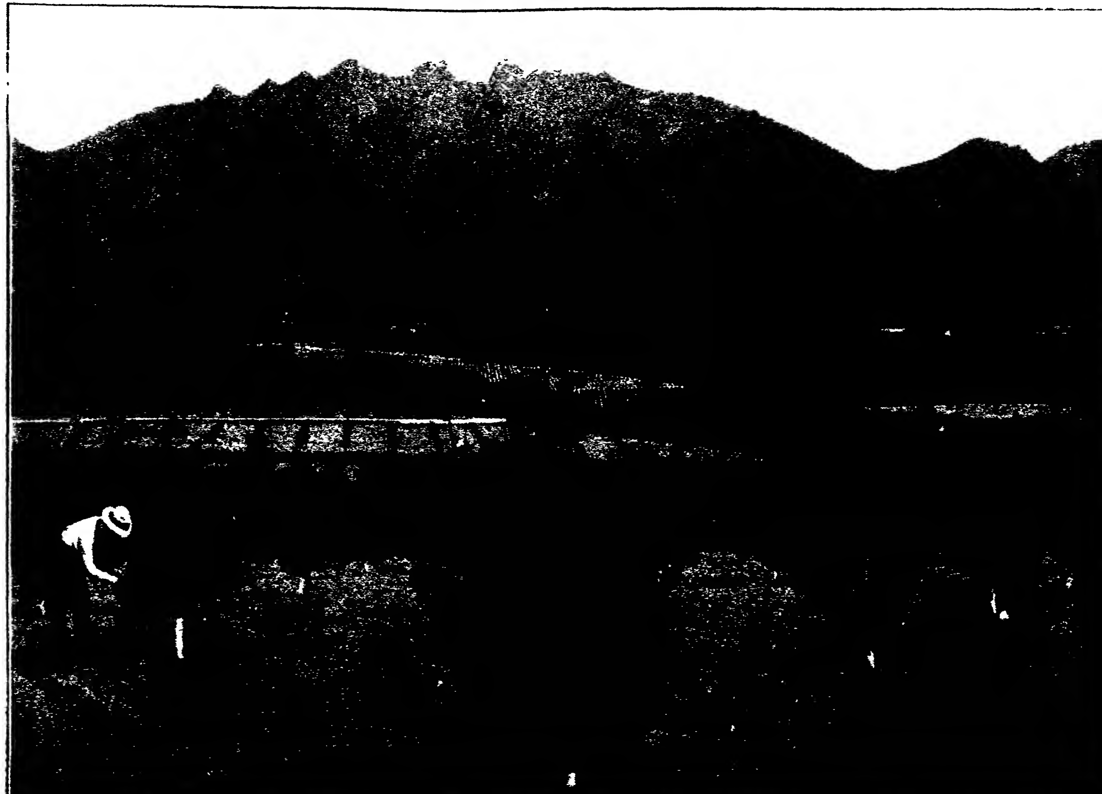
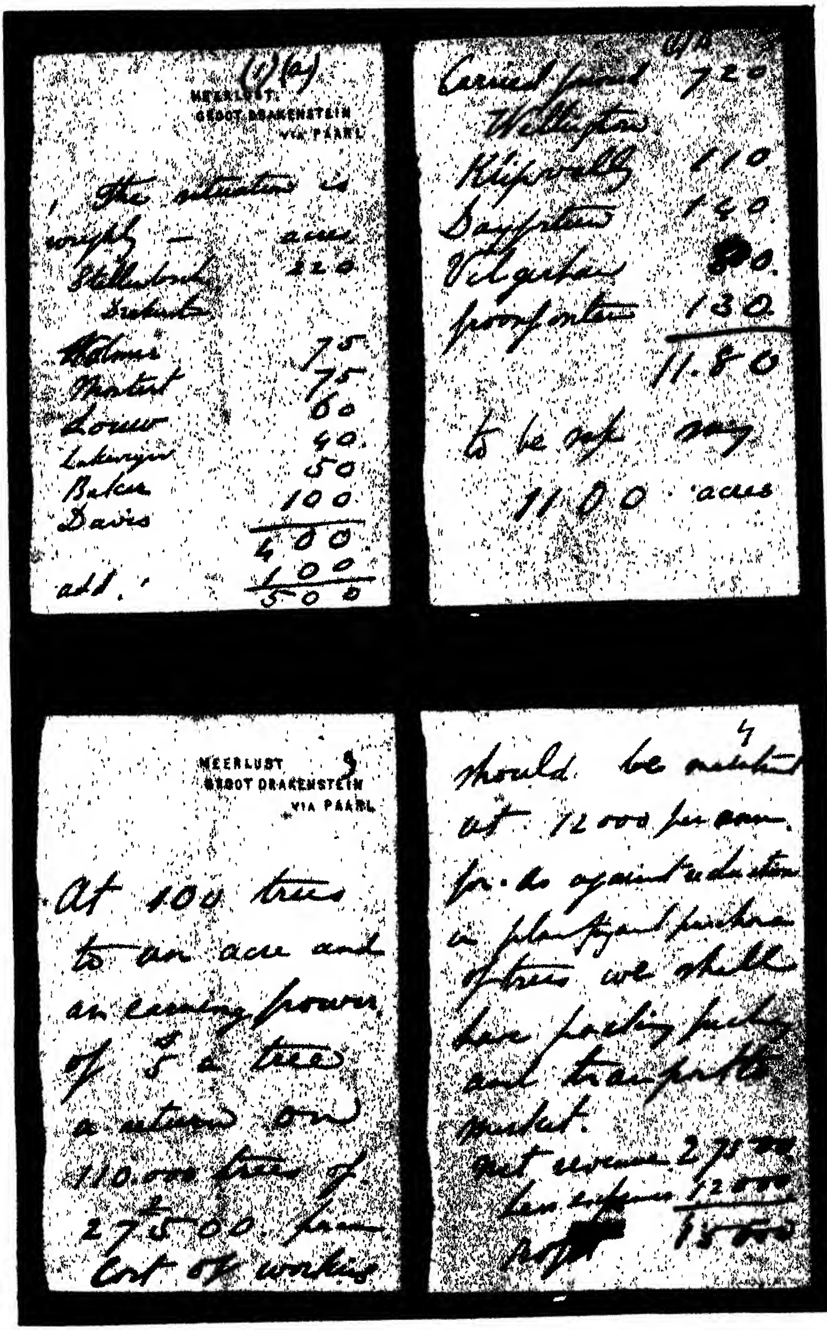


Plate No. XXIV. *Photo by Gribble, Paarl.*

ONE OF THE RHODES FRUIT FARMS, PAARL DISTRICT.



(1)(a)

MEERLUST,
GEDOT DRAKENSTEIN
VIA PAARL

the situation is
roughly — acres
Stellenbosch 220
District
Helmore 75
Mostert 75
Louw 60
Lategan 40
Baker 50
Davis 100
400
add 100
500

Carried forward 720
Wellington
[illegible] 110
[illegible] 120
[illegible] 80
[illegible] 130
1180
to be safe say
1100 acres

MEERLUST 3
GEDOT DRAKENSTEIN
VIA PAARL

At 100 trees
to an acre and
an earning power
of 5/- a tree
a return on
110,000 trees of
£27500 per ann.
Cost of working

4
should be estimated
at 12000 per ann.
[illegible]
in planting and purchase
of trees we shall
have packing facilities
and transport to
market.
Net revenue 27500
less expenses 12000
profit 15500

Plate No. XXV.

AN HISTORIC LETTER.

Rhodes' letter to Pickstone calculating the cost of laying out the Rhodes Fruit Farms.

Photo by Gribble, Paarl.

H E V PICKSTONE

Pioneer of the South African Fruit Industry.

Mr. H. E. V. Pickstone has the fair hair and the blue eyes of the Saxon type, and so we were not surprised to learn that he comes of English stock. But his tense and nervous temperament is the acquired characteristic of another race—that indelible mark left on the mind and muscle of every one who has lived and toiled amongst the most strenuous people the world has seen. Mr. Pickstone is a soldier by instinct, but a farmer by profession. And though he has done more than any living man to advance the fruit industry of South Africa, he is far more proud of the fact that, before he was twenty-one years of age, he had served Her Majesty Queen Victoria in three different continents in three separate branches of the Army Service. But let us now listen to his own words.

When did you come to South Africa?

Well, after returning to England I grew restless and decided to try my luck in the United States. I carried a letter of introduction to Mr. Andrew Carnegie who was then in New York. He advised me to try California. I did so, but the gold boom quickly ended, and I found myself stranded in San Diego, which was then crowded with miners. I got a job on the Santa Fé Railway as a day labourer. Not long after I was retrenched, and thereupon started out to walk to Riverside, a distance of 150 miles. I shall never forget my first impressions of that wonderful and picturesque town. Even at that time, many years ago, Magnolia Avenue was fifteen miles long and all planted with orange trees. To-day, as you are well aware, Riverside is the greatest citrus centre in the world, and it is all due to the Washington Navel orange.

At that time a good deal was being written about Cape Colony, and as I looked down on the mile-long orchards of Riverside the thought occurred to me that what California had done South Africa could also do. But I became a fruit grower by mere accident, being forced to do something to keep body and soul together. I needed money, and so took on a job at budding in an orange nursery. Then I did not know what a bud was. Nevertheless, I earned $2 (8s.) a day, and at the end of six weeks I could insert 1000 buds per day. I soon observed that other budders were making as much as $10 a day by contract work, and so I followed suit. But the intense heat knocked me up, and I started north, again seeking work, but finding none, until I struck the fruit farms of the Santa Clara Valley. Here I received tempting offers to remain permanently in California, but by that time I had made up my mind to devote my life to the development of some portion of the British Empire, and, accordingly, determined to sail for South Africa at no distant date. In order, however, to gain as much experience as possible, I became a contractor for all sorts of horticultural work in different parts of California. At last, having saved up a little money, I took out a

Plate No. XXVI.

PLUM ORCHARD IN BLOSSOM
(Pickstone's Fruit Farms).

Photo by Gribble, Paarl.

steerage passage and arrived in South Africa on 15th March, 1892, and walked up Adderley Street with a light heart and 30s. in my pocket.

How did you start without capital?

I had a letter of introduction from Mr. John X. Merriman to Mr. C. D. Rudd. Mr. Rudd mentioned my name to Mr. Rhodes, who asked me to call upon him. This I did, and, at the same time, told Mr. Rhodes that I was confident that South Africa had a splendid future as a fruit-exporting country. Mr. Rhodes seemed to be impressed, and at once offered to finance a farm for fruit growing. I then selected Nooitgedacht, which is now one of the Rhodes Fruit Farms. There I established a nursery of 50,000 trees, and imported all the best-known varieties of fruit trees from California—these being the first commercial importations into South Africa. This was in 1893. I then started branch nurseries at Wellington, Constantia, and Hex River. Next, in order to demonstrate what could be done in fruit growing on a large scale, I bought the farms of Meerlust and Delta in Groot Drakenstein.

In 1897 Mr. Rhodes entrusted me with the purchase and management of the Rhodes Fruit Farms. These farms cost, approximately, £250,000, and were intended to stimulate export trade, more especially in dried fruit. It is interesting to remember that the first two or three cases of peaches were exported to England by the Rev. J. P. Legge, of Stellenbosch, in the year 1892. To show the growth of this industry, I may remark that last season I exported from my farm of Meerlust, alone, more fruit than the whole of the South African export of a few years ago, namely, 19,500 cases of a net value of £4500. After the war, Lord Milner wished me to establish similar fruit farms in the Transvaal and the Free State with the object of developing the fruit trade of these Colonies. He allowed me to select my farms, which were to be bought by the Imperial Government, the purchase money to be refunded under the Land Settlement Act of that time. Not being able to find anything to suit me in the Transvaal, I finally selected Platkop in the Ficksburg District of the Free State. I guaranteed to plant 20,000 trees and to expend £7500 in development within a period of five years. I have now 35,000 trees and a capital account of £15,000.

How does South Africa compare with California as a fruit-growing country?

We can grow far better fruit, both deciduous and citrus, than California or any other country. Just now I am picking 600 Bon Chretien pear trees, and value this crop at £1200, or £2 per tree. Under the new mail contract arranged by the Government and Sir Owen Philipps, our fruit farmers have the best sea-borne freight rates in the world, which gives a permanent safeguard to the fruit industry of South Africa.

Mr. Pickstone's career should serve as a stimulating example to the youth of South Africa. As a mere lad he left a comfortable home close to the city of Manchester to become in the finest sense an "Adventurer of Empire." His splendid and varied experience on the Pacific Coast taught him, long ago, the true dignity of labour—a gospel so urgently needed to be preached from every pulpit and

Plate No. XXVII. SPRAYING AT MEERLUST FRUIT FARM. *Photo by Gribble, Paarl.*

Plate No. XXVIII Photo by Gribble Paarl

PICKING PEARS
(Pickstone's Fruit Farms).

every public platform throughout this country. And in spite of years of tremendous toil he seems still so absurdly young. We noted one fact of special interest. In the packing shed at Meerlust some coloured women were deftly and quickly sorting pears for the London market. We put the question to the manager: "How much do these packers get per day?" His reply was: "1s. 6d." Seven years ago we stood in the packing sheds at Riverside in California. A number of American girls were packing fruit with marvellous rapidity for the London market. In answer to the same question the Riverside manager replied $2.50, viz., 10s. per day. It is evident that, with cheap labour, low freights, and a truly magnificent climate, South Africa is destined to become before long the grandest fruit-growing country in the whole world. It is amusing to learn that Mr. Pickstone could find no land in the Transvaal to satisfy him some few years ago. But dry farming has changed all that, and to-day we are glad to see in every district hundreds of his trees now bearing heavy crops of luscious fruit. Indeed, wherever we see a blossoming orchard from Capetown to Bulawayo we call to mind the epitaph on the tomb of the immortal architect: "Wouldst thou behold his monument? Look around!"—a motto well worthy of the founders of the fruit industry of South Africa.

Our readers will note with interest the historic photographs courteously presented to the *Agricultural Journal* by Mr. Pickstone. The first photograph (see inset picture), namely, that of the late Mr. Rhodes, was taken only three months before he died while he was visiting Mr. Pickstone at Meerlust. It was taken by a mutual friend, Mr. Mullins, late General Manager of the Bank of Africa, and represents Mr. Rhodes in his most characteristic attitude. The second photograph, namely, the letter which refers to the origin of the Rhodes Fruit Farms, is of special interest because Rhodes estimates the output of a fruit tree at 5s. We now know that this estimate is too low. It is usual to calculate the annual profit from a good tree in full bearing—both deciduous and citrus—at £1.

The Home of the Ostrich.

Oudtshoorn, the home of the ostrich, is well and honourably known in the annals of South African agriculture, and there must be few indeed who visit this historic town without feeling proud of the fact that here at least is an industry in which South Africa stands supreme. Moreover, it has the added interest of having been built up in the lifetime of one man. Seventy-six years ago, Gert Olivier, the founder of the ostrich industry, was born in Oudtshoorn. He is still hale and hearty, and has lived to see this industry rise in value from a few pounds to over two million sterling. Of course there are to be found some faint-hearted pessimists who tremble for the future. There is no fear whatsoever. True, the price of feathers will rise and fall just like the market price of wheat, but so long as there are women in the world so long will there be a demand for the waving plumes of this beautiful bird.

The best and most enjoyable route to Oudtshoorn from Capetown is by sea. We left the pier of the Southern Capital at midday on the good ship "Galeka," and arrived at Mossel Bay at 11 o'clock next morning. This sweet little village nestles in a bay by the sand, the

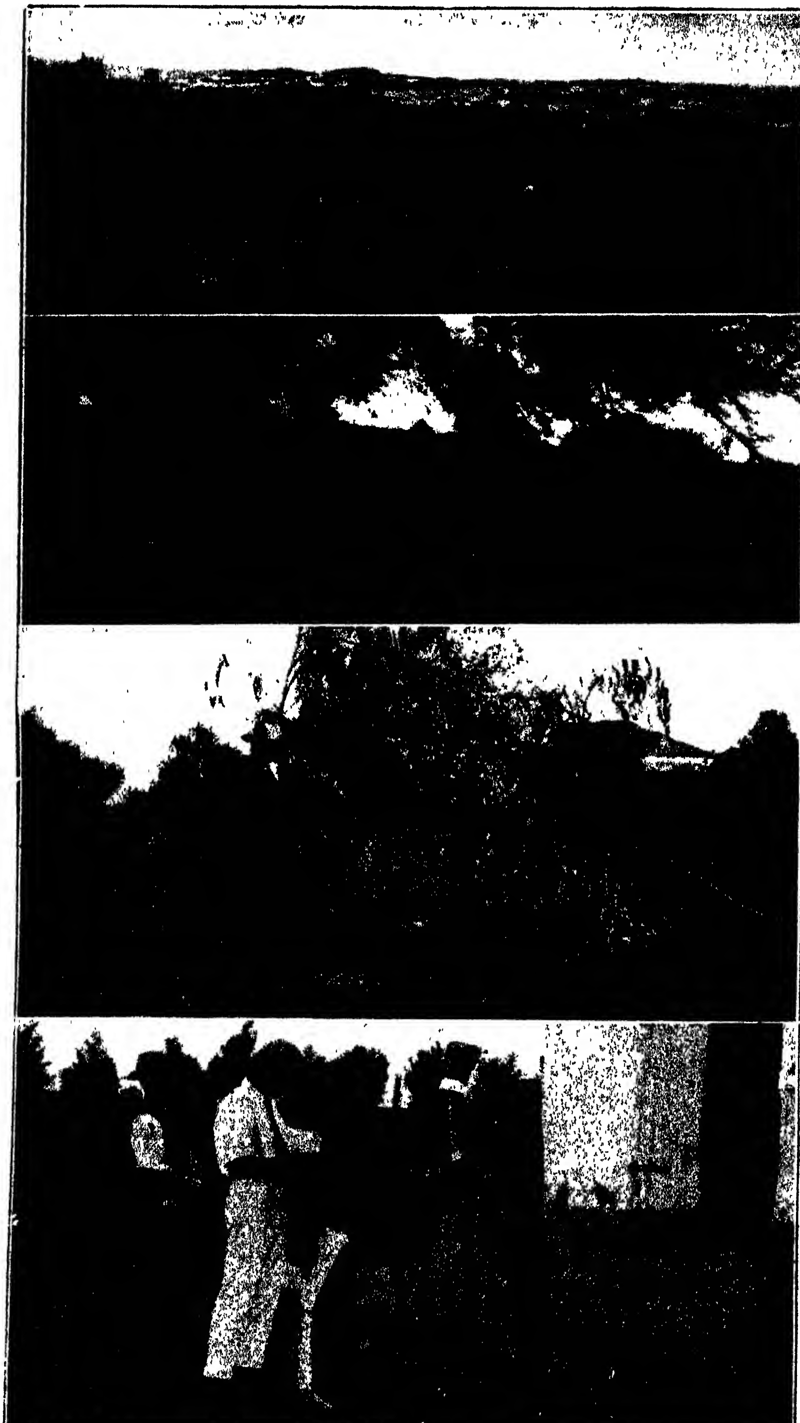


Plate No. XXIX.
1. Ostriches at Oudtshoorn. 2. Bird on Nest. 3. Gert Olivier, Founder of the Industry. 4. Plucking the Feathers.

Plate No. XXX. *Photo by A. Lewis.*

PLUCKING AN OSTRICH
(Mr. Isaac Gavin's Farm, Oudtshoorn).

rocks, and the sea. But already it is flowing over the hills and spreading out with the sweep of the glittering shore. Mossel Bay has suddenly awakened from the sleep of a lotus land, and even the mussels are now murmuring: "Let us surpass Port Elizabeth, East London, and Durban." Be that as it may, in two months' time the railway from the eastern ocean will reach Oudtshoorn, and the richest ostrich region in the world will be placed in direct touch with the feather markets of London, Paris, and New York.

The journey from Mossel Bay to Oudtshoorn—a distance of 56 miles—is one of the most picturesque in the whole of South Africa. The scenery is similar to the Scottish Highlands. You leave the sea-level and enter a splendid pass, rise over snow-white, mist-mantled mountains, to emerge in a green and fertile valley. The rainfall at Mossel Bay is 20 inches per annum, while at Oudtshoorn it is only 10 inches. But between these two places, so close together, lies the Robertson range, over 2000 feet high, which condenses the moist, warm air of the ocean before it reaches the Oudtshoorn valley.

In our quest for information as to the rise and progress of ostrich farming we were referred to Mr. N. H. O. Gavin, one of the pioneers as well as one of the most progressive growers. Mr. Gavin is Colonial born and comes of Irish parentage. He has been a resident of Oudtshoorn since the year 1887. His pretty farm Greylands is situated 9 miles west of the town, and comprises 360 morgen, of which 84 are irrigable and the remainder dry-land.

Kindly tell us something about the origin of this industry?

Ostrich farming was begun by the catching of wild birds some time between the years 1857-60. As far as I can gather the two men who are entitled to be called the fathers of the ostrich industry are Messrs. Van der Westhuyzen and Gert Olivier. They caught many wild birds which were then running on the flats, domesticated them, and bred from them. The feathers of these wild birds and their progeny were in great demand, and from £20 to £30 was paid for the full plumage of a single bird. I well remember on the market here an uncle of mine getting £20 apiece for the plumes of twenty-two birds. Nowadays, for far finer feathers, £6 is a fair average price. Some twenty-five years ago (1886-88) there was a bad slump in the price of feathers, which then realized only from £2. 10s. to £3 per plucking. At that time there seemed to be no demand for feathers.

The credit of first introducing lucerne to Oudtshoorn is due to a former magistrate, Mr. Scholtz. He sowed a small patch in drills in his garden. A little later my uncle, Richard Gavin, arrived from Ireland. He noticed this leguminous plant and thought it very like the clover of his old home. Accordingly he sat down and wrote to Phillip Bros., seed merchants, at Capetown, and asked them to procure some seed for him. This he sowed broadcast on a piece of land which is now a part of High Street, and there it grew luxuriantly. Then another of my uncles, James Gavin, bought a similar bit of ground which is now a portion of Queen Street. Here he likewise planted lucerne.

One of the first farms on which lucerne was planted on a large scale was Welbedacht ("well thought of"), which was owned by the Gavin Bros. I believe I am correct in saying that they were the first farmers in South Africa to realize that lucerne fodder could be used

Plate No XXXI *Photo by A. Lewis.*

THE PRIDE OF OUDTSHOORN.

Ostrich owned by Mr. Isaac Gavin, Welbedacht, Oudtshoorn.

not only to feed ostriches, but also for all kinds of live stock as well. Before their experiments it was practically unknown in this country. Since then every year more and more land has been laid down to lucerne, until you now see the large area under this crop in this district alone. You will not be surprised to learn that we consider it a truly wonderful plant. We can keep six birds to the morgen on irrigated lucerne land, and we can safely reckon on an average price of £8 to £9 for the plumage of good birds. The annual output of feathers from Oudtshoorn is now close on a million sterling.

What capital is required for ostrich farming?

Around Oudtshoorn a great deal is required when compared to other branches of farming in other parts of South Africa. This is mainly due to the very high price which must now be paid for land under water and lucerne in this district. Some of my neighbours are now buying more land for their ostriches at £300 per morgen. You may be interested to know that the whole of the arable land of the Oudtshoorn District, i.e. land under the plough and the furrow, is rated by our Divisional Council at an average price of £150 per morgen. In the face of these facts I would say that the prospective ostrich farmer should have £5000 to start with in this district. Nevertheless, the majority of our well-to-do farmers began their careers with little or no capital.

Let us suppose that a thrifty colonist buys ten morgen of lucerne land under water with certain grazing rights, and pays at the rate of £200 per morgen = £2000. He must then buy three pairs of birds at, say, £150 per pair, or £450. Next, he proceeds to erect outhouses, incubating rooms, and rough sheds for the chicks—the cheaper the better, because ostriches should not be pampered. Then he must purchase a wagon and mules, a span of oxen, ploughs, cultivators, and other farm implements. The cost of all this equipment may be placed at £1000. Wages and the cost of fencing must also be taken into account. A simple homestead may have to be erected; so that by the end of the first year he will have expended a fairly large sum of money.

With us the birds are mated in March and April. We allow the chicks to run with their parents until they are from two to three weeks old. Then we wean them and let them run on lucerne, giving them in addition crushed barley, bone meal, and limestone to aid their digestion. Many farmers run their birds on growing lucerne, but the best and most economical plan is to cut it and feed it in separate paddocks. There is less waste by this method and the plants are not injured by too close cropping. Young birds running on tender lucerne are liable to suffer from liver troubles. Old birds are seldom so affected.

The first feathers are pulled when the birds are from eight to nine months old. Some farmers clip their chicks when they are four months in order to form an even crop of feathers later on. The weight of a chick's feathers is usually from five to six ounces, and is valued at 45s. per lb. After six months we clip the wing feathers and the largest blacks, and pull the others. The first crop after the chick stage is worth from £6 to £10. Next, in from two to three months we pull the quills of these same birds, and six months later we have another plucking, and so on. That is to say, we have on an average

Plate No. XXXII. JUST OFF THE NEST. *Photo by A. Lewis.*

three plumages in two years and two months. Ostriches often live twenty years and more. But after their fifth plumage they seem to deteriorate and the feathers become narrower, shorter, and lighter. A mature bird gives eight ounces of wings and about sixteen ounces of tails and blacks or drabs. I have known some birds to give twelve ounces of wing feathers. The record price for a pair of ostriches in this country is £1000. The largest ostrich farmers in South Africa are the Potgieter Bros. They own over 5000 birds. Most of our feathers are sold locally, as we find that we get higher prices from the Oudtshoorn buyers than anywhere else in South Africa. These buyers ship direct to London, Paris, and New York.

Why is Oudtshoorn specially adapted to ostrich farming?

There are three main reasons. Firstly, the climate. The ostrich thrives best in a dry climate. Aridity is essential to the production of the finest feathers. The ostrich can stand a great deal of heat, but he does not like dampness nor extremes of heat and cold. Secondly, the Karoo soil of the Oudtshoorn valley is specially suited to the bird, probably due to the fact that it contains a good deal of salt and lime. Lastly, Oudtshoorn is well watered by two perennial rivers which make possible the growth of lucerne, or, in other words, a rich and abundant food supply. The pedigree ostrich, like the thoroughbred horse, needs to be well fed and well cared for if he is to give the best results. Neither ostriches nor horses can be expected to thrive if they are left to starve on poor veld grass.

The Oudtshoorn valley is roughly 70 miles long by 35 miles broad. We utilize the waters of the Grobbelaars and Oliphants Rivers for irrigating our lucerne lands. A large portion of our valley is composed of rich loamy soil. We find that lucerne does best in a sandy loam which has a substratum of lime. Our average annual rainfall is 10 inches. This is a very important point. Take, for example, the ostrich country around Grahamstown, where the rainfall is 30 inches per annum. There the farmers cannot produce three crops of feathers in two years—as we can—because there is too much moisture. Suppose rain falls when your feathers are ripe to clip it discolours them and spoils their lustre. Coming nearer home, the same thing is true of the ostriches in the Districts of Mossel Bay and George, where the precipitation is so much heavier than with us. Birds removed from the sea-coast to the Oudtshoorn valley pick up at once, and their feathers begin to show that extraordinary lustre for which our district is so justly renowned.

The stranger who visits Oudtshoorn for the first time is impressed with its general air of comfort and repose. He is not surprised to learn that this town, hemmed in by mountains and made rich by reason of the feather trade, is less sensitive to periodic waves of depression than any other part of South Africa. Unquestionably here are to be found the wealthiest farmers in the Union with, we understand, incomes ranging from £1000 to £50,000 per annum. But once outside the town one is struck with the poorness of the farming—the water-logged land, the weedy lucerne fields, the ringworm-like spots, and the careless fencing—all calling aloud for the hand of the diligent husbandman. Does the Oudtshoorn farmer forget that men are now raising ostriches in the valley of the Orange as it sweeps from Prieska

Plate No. XXXIII. *Photo by* ? *Lewis*

A BUNCH OF FEATHERS.

Plucked from Mr. H. W. Fourie's birds, Baakenskraal, Oudtshoorn.

to the sea, in a dry atmosphere, under a 10-inch rainfall, on the richest lucerne lands in the world?

In this prosaic age it is a pleasant fancy to suppose that somewhere in the Oudtshoorn valley once lay hidden a golden casket which contained all the secrets of the ostrich industry, and which had brought good fortune to every farmer in the district. But one night when the watcher was sleeping this magic treasure was seized by a band of lithe-moving men who had travelled for many days from the dry-lands of the west. And as they feverishly broke open the mysterious box and unrolled the crumbled scroll, they found a single blurred and blotted line: "By the sweat of thy face shalt thou eat bread."

Progress in Entomology.

The central office of the Division of Entomology has been strengthened by the transfer of the Natal Entomologist, Mr. Claude Fuller, and his staff from Pietermaritzburg to Pretoria. This step became imperative owing to the large amount of work with which the central office had to deal. It is interesting to note that this recent change associates Mr. Fuller with the Chief of the Division, Mr. C. P. Lounsbury, the former having been assistant to the latter officer in the Cape Colony from 1896 till 1899, when Mr. Fuller took up the independent position of Entomologist to the Natal Government under Union. He will now act as assistant chief of the Division.

Mr. C. W. Malley, the Cape Entomologist, who before Union was Eastern Province Entomologist, will remain stationed at Capetown, and will continue his ordinary work while at the same time paying special attention to certain subjects. Inquiries with reference to insects from places anywhere in the Cape Province should be addressed to his office, Department of Agriculture, Capetown, but inquiries from other parts of the Union should be addressed to the Chief, Division of Entomology, Pretoria.

Efficiency and economy require that the administrative functions of the Division shall be exercised from its central office. Hence communications from any place in the Union regarding the registration and inspection of nurseries, plant and fruit removal regulations, and permits for the introduction from abroad of plants and beeswax should be addressed to the office in Pretoria.

Mr. C. P. van der Merwe, who had charge of entomological matters in the Orange Free State before Union, is now in charge of nursery inspection under the supervision of the chief of the Division. With him are associated Mr. A. Kelly (who was formerly Assistant Entomologist in Natal) and Mr. J. W. Hodgson (who was with the Transvaal Division of Entomology). Nursery inspection has been made much more of a feature in the entomological work of the country than it was before Union. Over 385 nurseries are now registered, and the inspection and control of these is a task of considerable magnitude.

The centralization of the administrative work has rendered possible the detachment of the former Government Entomologist of the Transvaal, Mr. C. B. Hardenberg, for a special investigation of insects injurious to the wattle (*Accacia mollissima*). Mr. Hardenberg

has been given headquarters in the heart of the wattle area at New Hanover, Natal, and inquiries from anywhere in the Union concerning his special work may be addressed to him. His services, however, are not available with respect to other subjects. The wattle bark industry is one of great importance—about 300,000 acres in Natal alone now being planted to the wattle. The inroads of insects have been attracting more and more attention in recent years, and Mr. Hardenberg's investigations have been taken up in response to urgent representations. The investigation is expected to occupy two or more years.

The system of having special officers set apart for the exclusive study of a particular pest is followed with great success by the United States Department of Agriculture, which now has one hundred and fifty entomologists in its employ. At the present time the Union Division of Entomology is too much understaffed to permit of other members being delegated to specialize on single entomological problems, but the country would undoubtedly be able to make profitable use of the facts so acquired. Indeed a much more complete knowledge is needed before farmers can be advised as how best to prevent or circumvent the ravages of the grain aphis, the maize stalk borer, the cutworm, and a host of other pests. This can only be done by thorough investigation extending over a series of seasons. As the staff of the Division of Entomology is augmented it is planned to take up the most important pests, one after another, and to pay them such special attention as is now to be devoted to wattle troubles.

An entomological exhibit is being placed on the principal agricultural shows and on as many as practicable of the smaller shows. It has been prepared by and is in charge of Mr. F. Thomsen of the Division, and farmers attending the shows are cordially invited to consult Mr. Thomsen with respect to the ravages of insects.

Crop Surveys.

The other day a progressive farmer who comes from the border of Natal in discussing the limits of crop zones remarked: "I do not try to grow ostrich feathers on a hog's back." His simile was arresting, picturesque, and true. And then our friend went on to speak of the enormous amount of money that had been wasted in South Africa during the last decade by men who tried to grow crops in unsuitable districts. We use the word crop in the widest sense to include all branches of husbandry. Much has been written about the urgent need for a systematic soil survey. There is much more need for a practical crop survey. Human energy may for a time overcome physical and climatic obstacles, but it is most unwise to force any crop, just because it suits your fancy, upon an unwilling climate or an unresponsive soil. If you want to grow oranges, then you must select a farm in the citrus belt; if you wish to farm sheep, then you must pitch your tent in a pastoral country. This matter of crop zones has come up in connection with a recent visit made by the Chief of the Division of Tobacco and Cotton to Cape Colony, and as a timely warning to our readers we venture to give a résumé of his report.

A short time ago Mr. Scherffius travelled from Capetown to Porterville to report on the prospects of growing cotton in that neighbourhood. Some prominent citizens of Capetown had taken a considerable interest in this enterprise, and had encouraged a number

of farmers to plant trial plots of cotton. After a thorough investigation on the spot Mr. Scherffius advised the promoters of the scheme not to put any more money into it. He pointed out that although cotton could be grown on the vlei lands and on other soils where irrigation was possible, the locality in question was essentially a grain district; that the climatic conditions were not favourable to cotton culture, and that other crops might be more profitably grown. On the other hand, he spoke favourably of the future of tobacco. He visited some fifty Turkish-tobacco farmers who are growing this crop under the supervision of the Department of Agriculture. In spite of the fact that severe windstorms destroyed several thousand pounds weight of tobacco, a crop of 260,000 lb. is expected, which will in some respects be superior to any previous harvest. Already the farmers have formed a co-operative company, and have leased a building in Paarl in order to properly handle the crop. It is estimated that 90 per cent. of the tobacco will be delivered to this warehouse, and there is every indication that growers will do better by this method of disposing of their crop than they did at the last auction sale.

What is an Experiment Station?

There seems still to be some confusion in the minds of many as to the real functions of an experiment station. It is not uncommon to hear some of our friends criticizing the poorness of the crops which are to be seen growing on the Government Experiment Stations. Criticism is indeed essential to the well-being of a live Department of Agriculture. But it should always be constructive and based on a correct understanding of the purpose in view. Take, for example, the humble mealie. It is easy enough for the manager of any experiment station to grow a good crop of Hickory King; but if he carries out experiments with a new breed of maize from Mexico or Peru he may well expect the first year a feeble growth and a poor stand because the new variety has not yet become acclimatized. And the thoughtful ruralist who sees a puny plant will not jump to the conclusion that his own splendid ten-foot crop is necessarily the result of his superior skill in cultivation. The farmer has neither the time nor the money to conduct elaborate experiments. That is a matter for the Government; and if one crop is hastened by a liberal dose of fertilizers while another, close by, is eking out a miserable existence in a new and uncongenial climate, the intelligent farmer will neither over-estimate the merits of the one nor under-estimate the possibilities of the other. We well remember listening to an illuminating lecture on plant selection by Professor A. L. Woods, who is now Director of the College of Agriculture of the University of Minnesota. He had just returned from an agricultural tour in Russia; and what surprised him most of all was to see here and there little patches of wheat which had been left to ripen in many of the fields. He inquired the reason and was told that these tiny patches of corn was all that had survived from the last season's drought.

An American farmer, Doctor Woods remarked, would in despair have ploughed under those few isolated patches; but the patient Russian peasant carefully reaped the last ears of his damaged crop, and it was this simple process of selection, unconsciously pursued over many years. that at length produced the wonderful drought-resistant

durum wheat of Russia. In this connection we may remark that Mr. Burtt-Davy, the Government Botanist, is making rapid progress with his maize breeding experiments at Groenkloof, Pretoria. He finds the situation there more convenient, and the soil much better for experimental work than the previous station at Skinners Court. It will interest our readers to learn that he recently reaped ears of dead ripe maize in eighty-two days. This constitutes a record. A short time ago the thermometer fell to 37° F. at the Standerton Stud Farm. The value of a quick ripening mealie for late planting is a matter of great importance to our farmers on the high veld.

The Lesson of Central Control.

The other day there passed away at his home near Dublin a great veterinarian, Mr. Matthew Hedley, Chief Veterinary Inspector to the Department of Agriculture in Ireland. He was the foremost exponent in Great Britain of the policy of central control in stamping out contagious disease, and his life is a lesson to the people of South Africa. In Ireland the prevention and eradication of disease is a matter for the central administration; in England it is the local authorities who carry out the regulations dealing with the diseases of animals, with the result that while animal disease is still rife in the latter country Ireland is now freer from epizootic disease than any other part of Europe. Hedley suppressed pleuro-pneumonia, rabies, and glanders, but he will best be remembered as the man who met and conquered foot-and-mouth disease in Ireland at two different periods ranging over thirty years. The recent outbreak of this disease was only discovered in Ireland by its detection in England in some cattle which had been imported from Ireland. Mr. Hedley quickly set to work to locate and map out the spread of the disease. His staff of inspectors travelled far and wide throughout the country armed with instructions to carry out a vigorous policy of prevention and eradication. For a time all trade in cattle was stopped, but ere long the disease was completely stamped out.

For many months Hedley was at his post day and night, and there is no doubt that his sheer devotion to duty undermined his constitution. His services on behalf of the live stock industry of Ireland were warmly praised in the House of Commons. His students are to be found scattered all over the world. They mourn a mighty worker and a splendid personality. It is worthy of note that Mr. J. A. Christy, M.R.C.V.S., Senior Veterinary Surgeon for the Transvaal, was trained under Hedley.

If you visit the ancient cathedral of Seville when the sun is streaming over the tombs of the illustrious dead you will read those simple lines: "To the Victor of Santa Fé—Conquered at his own cost." America may produce her multi-millionaires, but the Spaniard still ranks a life of self-sacrifice as the grandest stake in human destiny.

Life of De Laval.

The other day at Stockholm took place the death of Doctor De Laval, the inventor of the cream separator, in his sixty-sixth year, and we are sure that our readers will be glad to learn something of the life of this remarkable man who did so much to revolutionize modern dairying.

Carl Gustaf Patrick de Laval was a native of Dalarne, Sweden, and the son of a surveyor. From his earliest youth he showed an extraordinary aptitude for mechanics. After a distinguished career at the Royal Technological Institute in Stockholm, he graduated there as a mechanical engineer, and received an appointment on the Falun mines. But his intense desire to increase his store of learning led him to leave the practical work of the mine and again become a simple scholar. He entered the University of Upsala, and for a period of five years devoted himself assiduously to chemistry, physics, and mathematics, and finally graduated as Doctor of Philosophy. A little later he obtained a temporary post at the Klosten ironworks. It was here that he got the first idea of a separator. He made some experiments to demonstrate how cream might be separated, and called the attention of the manager of the ironworks. He did not succeed, however, in converting his chief, who probably told him that he was employed in an iron-foundry and not in a cow-house. In any case, De Laval laid down his tools, threw up his job, and turned his steps once more to Stockholm. This was in the year 1877. Then followed a period of incessant toil, much anxiety, and many disappointments. But, at last, he knew he had achieved his object. At any rate his machine would separate the cream from the milk. It consisted of a cylinder into which milk was poured, and which was kept in rotation until the cream was separated from the milk. The machine was then stopped, the cover of the cylinder taken off, and the cream scooped out. The separator was shown at work to several large estate owners, one of whom said: "It is certainly an interesting experiment, but, practically, the invention is worth nothing. On a large estate one would require sixteen to twenty such separators to skim the milk, and that would be too expensive." Notwithstanding this discouraging remark, De Laval never lost heart, but straightway began to alter his separator so that it could take in a continuous flow of milk and, at the same time, give off the cream and the skim milk separately. His attempt was crowned with success, and he considered his machine now ready to be placed upon the market.

Owing to his costly experiments, De Laval was unable to raise the necessary capital for the manufacture of his separator, and he therefore entered into partnership with two other persons. On 23rd December, 1878, the first separator was sold, and before the end of the following year 146 machines were in use. In 1882 this small syndicate was dissolved and a company formed with the Doctor himself as a member of the Board and a large shareholder. The number of De Laval machines now in use is over 100,000. To illustrate how greatly the separator has been improved within recent years, we may mention that, while in 1879 it was necessary to employ a two horse-power machine to separate 22 gallons per hour, only ten years later 45 gallons an hour could be separated by a hand-power machine operated by a girl. Doctor De Laval invented many machines not strictly connected with the dairy industry, and, outside his separator, he will be remembered best for his invention of a light steam turbine. Latterly, he was engaged on a milking machine which, we understand, his company have recently put on the market. De Laval had a mind of outstanding originality, and honours were heaped upon him. But he remained a simple, kind-hearted man of science, whose death will be deplored by dairy farmers the world over.

The Month and the Magazines.

Country Life has a most instructive article on "Education for the Colonies." This is an account of an emigration training farm at Woking which has been founded by the Hon. Rupert Guinness. The object of this farm is to afford a practical training to young men similar to what they would receive on a farm in the Oversea Dominions, more especially in Canada. The barns, buggies, and farm implements are all Canadian. The hours of work are the same as those on a Canadian farm. Students must rise at 4.45 a.m. and feed and milk the cows, groom and harness the horses, and clean out the stables. Breakfast at 6.30, work from 7 till noon with horses, cattle, or in the forest or fields. There is an hour for midday dinner—"plenty but plain"—and work from 1 to 6 p.m., after which supper, and last of all the final look at the animals; at 9.30 p.m. lights are out. This may seem a laborious day, but it is typical of ordinary farm life in Canada. Such a day would not be felt by those lads with a genuine love for farm work, but it is likely to cure all those who have no special taste for farming. The majority of youths now working at Woking hail from Eton, Harrow, and Rugby, and were probably brought up to think that such menial labour should be done by servants, just as there are some bright lads in South Africa who maintain that manual labour is the perquisite of the unsophisticated Kaffir. There is no fee for tuition. For the first six weeks the student is charged 25s. a week for his board, which is reduced afterwards if he proves efficient. In some cases a small weekly wage is granted, and situations are provided in Canada for all those who prove keen and hardworking. This is a capital scheme and worthy of the highest praise.

For lads who propose to farm in South Africa we would suggest some lessons in ploughing with oxen. The other day we heard of a man who had been severely trained on a first-class farm in Scotland before coming to this country. He is now the successful manager of a large property near Volksrust. Yet he deliberately stated that, apart from the lesson of hard and continuous labour which he had learned in his native land, he doubted if his Home training had been of any use to him—so different were the farming methods of Scotland and South Africa.

We have long maintained that South Africa is the finest orange-growing country in the world. Orange land is certain to rise in value. It is therefore of interest to read about the great demand for citrus land in California. In the *Pacific Rural Press* we note what is stated to be a record price. A small farm of five acres set to oranges and lemons in Orange County was bought by Mr. M. N. Hunton for $2400 (£480) per acre.

The Fruit World has issued a brightly written brochure on Queensland, showing its agricultural and pastoral possibilities. From this publication we observe the liberal immigration policy of the Queensland Government. Intending new settlers from Great Britain, approved of by the Agent-General and who deposit with him a minimum sum of £10, are granted passage to any part in Queensland. Of this amount £5 will be applied to passage money, and the balance will be returned to the settler on his arrival in Queensland. Furthermore, free passages may be granted from the United Kingdom to any part of Queensland to agricultural labourers introduced to the State

under contract if the employer pays a fee of £5 for each labourer introduced, provides him with suitable accommodation, and guarantees him a year's employment at wages approved by the Chief Secretary.

In *The World's Work* Mr. Eugene Grubb, a well-known potato grower of Colorado, who has been making a tour in Europe, gives his opinions of British farming. What impressed him most of all was the fact that Lord Rosebery grew 24 tons of potatoes on an acre at Dalmeny, near Edinburgh, on land which had been cultivated for a thousand years. Mr. Grubb says that there are thousands of acres of land in the United States which have been worn out by bad farming, and he asserts that England is far ahead of America in agricultural practice. He was surprised at the life of comparative comfort and dignity led by the farmer in the British Isles compared with his own countrymen. This success he attributes to care of the soil and seed selection. The *Live Stock Journal* states that the gross business transacted by the four leading Chicago packing companies in the last fiscal year aggregated to about £175,000,000. To this total the Swift Company contributed more than £60,000,000, the Armour Company about £50,000,000, the Morris Company about £35,000,000, and the Cudaby Company £20,000,000. The total is about equal to the gross revenues of the four largest railroad systems in the United States.

In *American Forestry* there is a question which will no doubt receive the attention of our own Forest Department. It is: "Do broken bottles start fires?" A Washington forester points out that smoke may be seen arising from broken beer bottles, which act as burning glasses and may cause a serious conflagration. The whole matter is to be investigated by the State Forest Fire Service.

Our dry-farmers will be interested in the statement made in the *American Miller* that the United States Department of Agriculture has imported a new variety of Durum wheat from South-eastern Russia, where it was bred at the Government Experiment Station. It is a black bearded wheat having very large open ears, and is said to be very hardy. It is called Teiskaia. The same paper says that the prices now obtained for Durum wheat should be satisfactory to those concerned. There is to-day practically no difference between the price of Durum wheat and "No. 1 Northern" at Minneapolis and Duluth. 40,000,000 bushels of Durum wheat are now raised in the United States, and the gradual rise in the market price of this dry-land wheat is due both to the export demand and also to the increased skill of the millers in handling it.

There is also a note in the above-mentioned periodical regarding Dr. Aaronsohn's wild wheat. It will be remembered that a sensation was caused in the scientific world by the discovery of wild wheat in Palestine a few years ago by Dr. Aaronsohn, who is the Director of the Agricultural Experiment Station at Haiga, in Palestine. He read a paper on the subject of his discovery at the annual meeting of the International Dry-Farming Congress. Dr. Aaronsohn has now planted his wild wheat at the Government Experiment Station at Chico, in California. It is expected that from this wild wheat will be bred varieties of wheat which will grow in rocky, shallow, and dry soil without cultivation.

In the *Rhodesian Agricultural Journal*, which is an admirable publication, there is an article on Citrus Fruit Growing by

Chas. E. Farmer, Citrus Expert to the British South African Company. In discussing the question of irrigation Mr. Farmer says that he is of opinion that well-sheltered and properly cultivated orange groves will produce remunerative crops without the artificial application of water. In other words, he is convinced that oranges can be grown on the dry-land system. We have always believed this to be true; and it means that a magnificent future lies before the citrus farmer. South Africa is going to be as supreme in the orange industry as she is at present in ostrich feathers.

Agricultural Tour in the United States and Canada.

By A. M. BOSMAN, B.S.A., Government Agricultural Scholar.

(Being a Report presented to the Secretary for Agriculture.)

MANY of the agricultural problems in Northern America are dissimilar to those obtaining in South Africa; again, there are those which correspond very closely to South African conditions, and it is chiefly with these latter ones that I wish to deal, and, if possible, to draw some conclusions therefrom that might apply to certain agricultural methods as they are practised in South Africa.

After the completion of my course in agriculture at Guelph, Ontario, Canada, I felt it was desirable that I should make a further study of dry farming, irrigation, and of the mule and sheep industries of America. A three months' tour gave me a fair insight into American agricultural practices, and—what I consider of greater importance—brought me into touch with prominent agricultural investigators, from whose experience and labours we may derive great benefit.

Accompanied by Mr. S. Rogers, a South African and a graduate from the Ontario Agricultural College, I visited the following places:—

PURDUE UNIVERSITY, LAFAYETTE, INDIANA.

Through the kindness of Professor Goss, the Director of the Experimental Department, we were put into touch with the State Chemical and the Agricultural Extension Departments. The former sends out its inspectors to the different factories of animal foods and manure stuffs; these inspectors have the power to visit any factory within their round at any time and to take samples from any bag put up for sale by the factory. The sample is then mailed to the Chemical Department where a record is kept of the composition, date of inspection, etc. By means of numbered tags the dates of inspection are

also recorded on a map of the State and thus, at a glance, one can see which inspector visited a certain factory and when he did so last.

If the manure or foodstuffs do not reach the required standard of composition the manufacturer is at once notified to improve his product. A sample of every sample tested is kept under lock in a large storeroom, so that a re-test may be made in case the manufacturer disputes the official composition test. This sample is kept for one year after the date of inspection.

The revenue for carrying out this work is obtained by the sale of tags, on which is printed in bold type the exact chemical composition of the material put up for sale; all bags on the market have to be labelled with these tags, and by this means the farmer is protected against the adulteration of food and manure stuffs. This system may also be extended to protect the farmer, who is not always in a position to understand these things, against the adulteration of the poisons with which he has to combat insect and fungous pests.

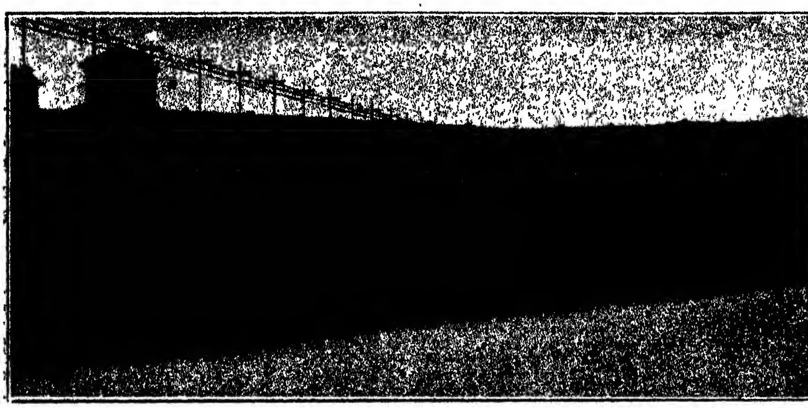
The Agricultural Extension Department, under the leadership of Professor Christie, does excellent work in the way of placing agricultural truths before the farmer in a practical and graphical manner. Pictures of agricultural value are mounted in such a way as to be both attractive and instructive; quantities of agricultural products are grouped together so as to represent, at a glance, the results of a definite continuous experiment; noxious weeds are mounted and methods of eradication given, so that the farmer can get an opportunity of knowing how to destroy them; weed seeds are exhibited to warn the farmer against impure seed; injuries done to crops and seed and the causes thereof are shown, so that the progressive man may know that it is not "providence" working against him but that the control of such diseases and insects lies largely in his own hands. Each department prepares its own box or boxes of mounted exhibits, photos, and explanations. These boxes are strong and stand shipping well; the double folding doors only need to be opened to exhibit the material.

The Agricultural Extension Department also does extensive work in the way of travelling agricultural schools—"better farming" special trains, etc. Competent men with a thorough knowledge of their work are invited and employed to lecture to and answer questions of farmers, and to try and convey to them the more important essentials of successful agriculture. The boxes, before mentioned, are used on these trains at country fairs, lecture halls, etc., to try and convince the more conservative farmer that the "good" is not "good enough," but that there is a "better" beyond and within his reach.

During such tours an attempt is made to organize farmers' clubs, boys' clubs, etc., with the object of furthering agricultural interests. Judging contests of live stock and field crops are instituted for the boys and prizes awarded to the best judges.

In these various ways the Agricultural Extension Department arouses the interest and curiosity of the farmers, encourages them to experiment on their own farms, assists them to produce "more" and of "better quality," and, in general, promotes the agricultural welfare of the State.

This department does not do any actual experimenting, but simply gathers results of experiments that have proven themselves to be true in at least four or five successive years of experimenting. In taking this last precaution approximately all danger of faulty information is



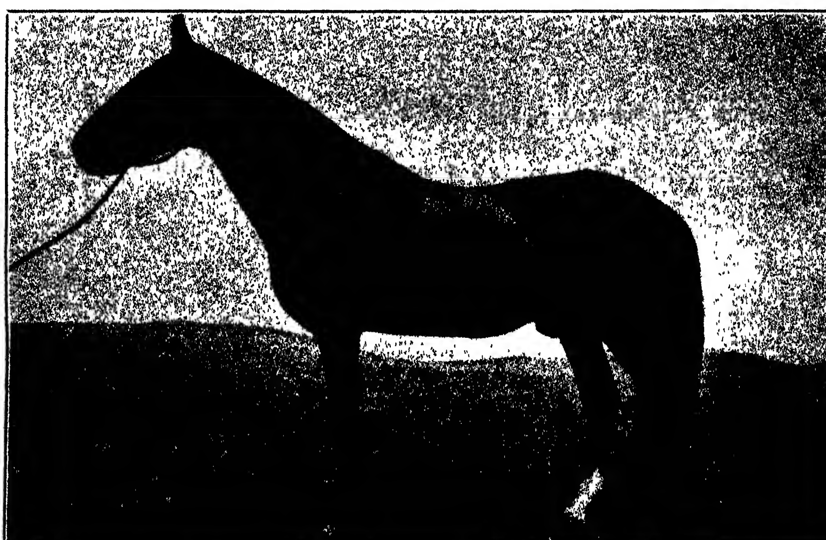
Dairy Barn, showing two wings of building, two silos at one end, and cans transported by trolley system.

The Creamery, showing transportation of milk cans.

Plate No. XXXIV.

removed. The farmers can then trust and accept the results of the various departments and thus both experimenter and farmer are benefited.

There are various other points of interest at Purdue University. I shall mention only one more. Great strides have been made in America within the last few years in controlling that fatal disease of pigs, viz., "hog cholera," and, under the direction of Professor Craig, Purdue University has contributed very materially to the successful control of this dreaded disease. The infected pigs are bled at the tail and small quantities of this blood is then injected into a healthy pig through the ear vein; the animal becomes first immune and then, with greater injections, a hyper-immune animal is produced, thus forming a source for obtaining serum. By means of the serum-simultaneous method the young pigs are inoculated at weaning time—it is easier to inoculate a young pig—and the animal remains immune for life.



American Standard-bred Stallion.

Professor Craig is at present working on a method of injecting, into various parts of the body, a salt solution with only a little serum to produce a hyper-immune animal, the object of this being to reduce the cost of producing serum and to be able to inoculate more pigs with the same quantity.

We also visited a few of the prominent breeders near Lafayette. I saw the champion Belgium and Percheron of both America and Europe at Crouch & Sons. Mr. J. van Natta's Hereford cattle farm was well worth visiting; there I saw what judicious inbreeding can do towards perfecting the Hereford breed and similarly any other breed of animals.

KENTUCKY AND MISSOURI.

Lexington lies right in the famous Bluegrass region, noted for its fertile soils, excellent blue grass (*Poa pratensis*), fine stock farms, and its beautiful landscapes.

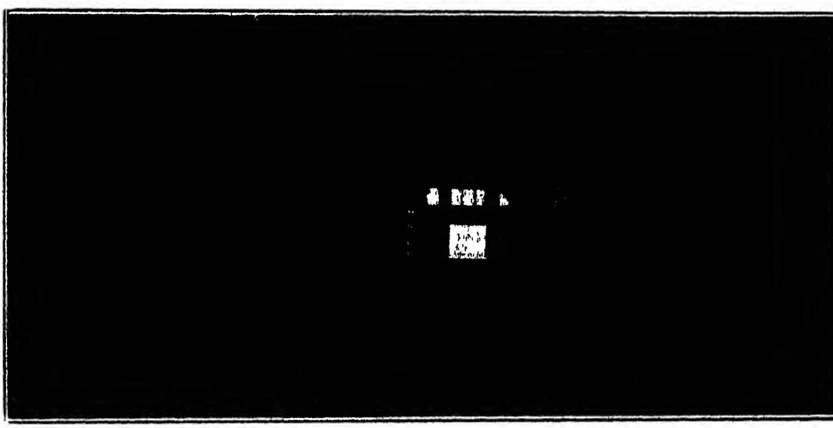
Precipitation is distributed fairly evenly throughout the year, forming an average of about 44 inches.

We had an opportunity of visiting "Elmendorf farm," which is owned by the millionaire John Haggin; the whole farm covers an area of about 8000 acres. There are American standard-bred stallions valuing up to $125,000 (£26,000).

The dairy at Elmendorf is worth while mentioning. It consists of a huge cross-shaped brick building with accommodation for 100 cows in each wing.

One end of this cross-shaped building forms the main entrance, and at each of the other three there are two wooden silos where enough silage can be stored for the 400 cows (chiefly Jerseys). The milk is collected in the centre of this building, where a man marks the cans and then transports them to the upper story of the creamery (100 yards away) by means of an overhead trolley system.

The cans are received in the creamery by a man (who is always dressed in white), who empties them into a funnel, where the milk is



Horse Stable, Walnut Hall.

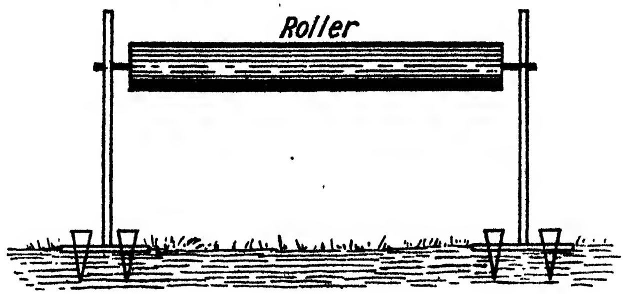
strained on its way down to the pasteurizer. After pasteurization the milk is not handled at all by the men; the bottles are filled and corked by machinery. Butter is also sold very extensively.

We visited "Belmont" and Walnut Hall," horse farms, owned by Mr. Belmont and Mr. Harkness, respectively. I think I am safe in saying that we saw the best thoroughbreds that Kentucky can produce, ranging in value up to $175,000 (£36,000) in price.

The horse stable at Walnut Hall was the best and roomiest I saw anywhere. There are two rows of roomy box stalls on either side with a wide gangway in between. The sides of the stalls slanted inwards from 4 feet above the ground; this prevents the horses from hurting themselves against the walls.

The sheep at Walnut Hall were under the management of Mr. Blastock, who showed us round. He kept chiefly Hampshire sheep, which flocked well provided they had shelter and good pasture, of which there was an abundance. For general hardiness and flocking qualities, however, they do not come up to the Merino sheep. The ewes were kept in breeding condition—they were, therefore hurdled

off on pastures where the lambs had been the week before—thus the lambs are kept under very favourable condition for quick growth, which can only take place when the animal is young. This point is often lost sight of by the farmer; if more attention is paid to the growth and welfare of the young the future generations will increase instead of decrease in vigour.



When the breeding ewes follow on this pasture there is just enough left to keep them in good breeding condition, not becoming too fat. The lambs in the meantime are hurdled off on to new pasture.

This system of pasturing also checks the growth of weeds; in fact the value of sheep as weed destroyers is often overlooked, yet it is of no mean importance, since of all animals a sheep destroys the germinating powers of weed seeds best during digestion. It is also a great help in maintaining the health of the lambs, as they are not transferred to old pastures and therefore the danger of worms and other diseases is eliminated.

Blue Grass (*Poa pratensis*) Pasture.

The sheep which are to be fattened for the market or for shows are pastured on a mixture of maize, oats, and vetch; they are hurdled off on to small patches at a time to prevent them destroying the pasture by tramping. Three or four pastures are prepared thus so that when one field is pastured off the other will be ready. These are sown at different times.

A simple arrangement is fixed up by means of which the sheep can scratch their backs without injury to the wool (see diagram).

At the time when the ram is placed amongst the ewes he is marked between the front legs with a paint that does not injure the wool; when the ewe is served, therefore, she is marked on the rump by the ram; when two or more rams are used they are painted with different colours. The date of service is then entered in a book. By this means track may be kept of the sire and dam of any lamb, which is then marked in the ear at, or before, weaning time.

The Shorthorn breed of cattle was the favourite beef type. They are all kept on the splendid Kentucky blue grass pastures.

We visited a number of Jack farms, of which there are a great number both in Kentucky and Missouri.

Much bone of good quality, length of ears, masculinity of head and carriage, constitution, and strong back are the qualities most sought after in the Spanish Jack.

Missouri College.

The Missouri mules are generally bigger boned and larger than those bred in Kentucky, because there the Jacks are used mostly on draft type of mares. These mules are inclined to be rather sluggish and not so persevering and active as mules bred from the thoroughbred type of mare.

NEBRASKA.

On our way to Lincoln, Nebraska, we spent a few hours in Omaha to look over the more important dry-farming machinery.

At Lincoln we met Professor Burnett, who is the Director of the State Farms and Dean of the Agricultural College; he put us in touch with the various departments and experimental stations, and gave us a splendid outline of how the irrigation systems of Nebraska are kept under, or else passed into, the control of the farmers whose lands are irrigated.

Another system is to loan the water-right to a company, but in such a case, within a contracted number of years, it reverts back to the people, who can again make a new and perhaps a more profitable agreement with the company if they so desire.

A £300 Jack.

A Missouri Mule.

Plate No. XXXV.

Space will not allow me to discuss these systems fully.

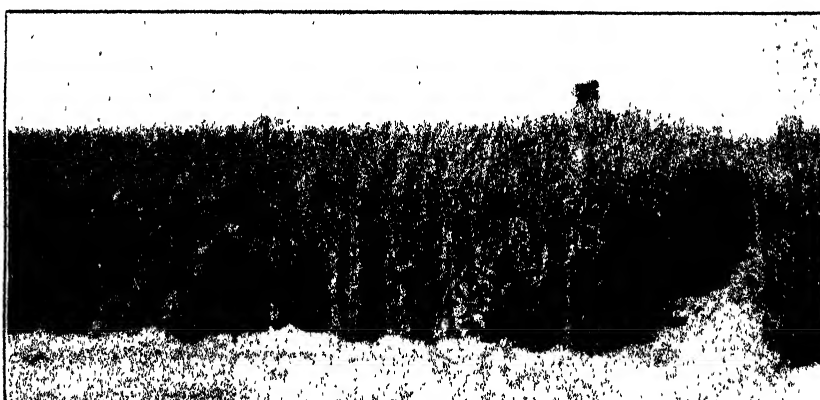
Various experiments were taken note of in the Departments of Agronomy, Animal Husbandry, and Dairying, but these, too, cannot be discussed here.

NORTH PLATTE, NEBRASKA.

North Platte lies in the area drained by the Platte River; the surface soil of the whole region contains a large percentage of sand.

At the experimental farm the surface soil is a sandy loam. The sub-soil, to a depth of 20 or 30 feet, is very much of the same texture and colour, except for the natural colouring of the humus in the surface soil. This kind of even, deep soil, which is not too light, is, of course, the ideal soil to conduct the moisture stored up in the lower strata to the surface soil and is, therefore, the ideal dry-farming soil.

The average annual rainfall at North Platte is about 18.5 inches. At the time I visited the station the annual rainfall averaged only



Dry-land Wheat on Rye ploughed in.

about 13 inches. Most of the precipitation takes place in the summer months of May, June, and July. The relative humidity is low and the section is sometimes visited by warm, dry winds; evaporation would, therefore, greatly reduce the net annual precipitation. The warm, dry winds (as in the spring of 1912) also often cause great injury to the setting of grain flowers, and thus decreases the yield of wheat, etc., to a great extent.

Mr. Snyder and Mr. Burr superintend all the experiments. Mr. Burr has done much in finding out the practical value of capillary action in the soil; he is rather inclined to believe that capillary action in the soil goes on too slowly to supply the plants, and, therefore, on dry farms the roots move downwards to the water instead of the water coming up to the roots. There is too much to be said about this to be discussed fully here.

In the rotations worked out alfalfa does not pay, for although it enriches the soil enormously yet it dries out the soil too deeply, and when it is ploughed under the following crop suffers severely from lack of moisture. For a hay crop, however, alfalfa does excellently once it gets started.

Peas proved a better crop for rotation; it gives all the necessary nitrogen and humus to the soils when it is ploughed in; it does not dry out the soil so deeply, and the humus turned over makes the soil more retentive for water. Small grain generally follows on the peas ploughed in.

Summer fallowing is expensive, but it is often resorted to where the rainfall is very small. The land is then stirred after each rain as soon as the ground is ready, and sometimes at other times as well. It has been said if a dry farmer does not know what to do next he should go and harrow his land. It is a moisture-saving practice and should be used more commonly. The corn (maize) seen in the pictures is all listed maize. The listed maize did not look as thrifty as the drilled maize, but the yield was much greater.

Dry-land Wheat on land ploughed 7 inches deep.

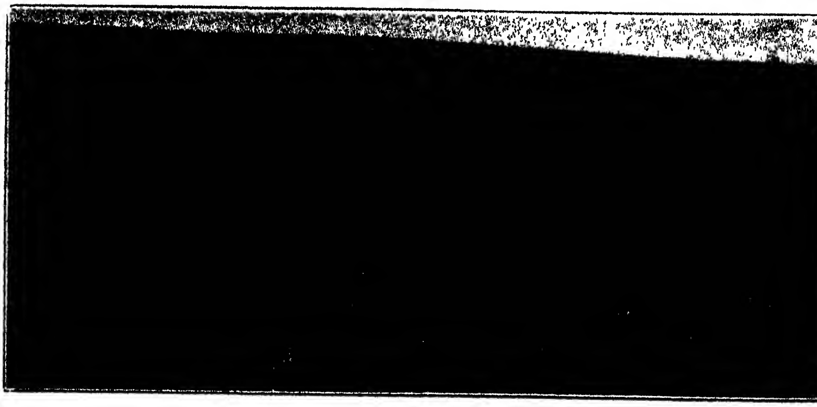
The following picture gives a general view of the experimental plots with the rotation: Fallow, oats, maize in the foreground.

The variety of oats which is most extensively grown is the Kherson oats; the best wheats for this section are the Turkey Red and the Kubanka; and the Calico corn is the most commonly grown maize.

Ploughing directly after harvesting proved to be a good moisture-saving practice. The practice of autumn ploughing generally gives much better results than spring ploughing, as the ground is in a condition to receive any late autumn or winter precipitation, and besides weathering goes on which brings about a fine condition of tilth to the soil.

The field illustrated above showed up very much better than where the ploughing was shallower.

(To be continued.)



Poor yield of Oats, due to Alfalfa drying out the soil in previous year.

Rotation : Peas, Oats, Maize. Ploughing in Peas and preparing ground for Oats next year.

General View of Dry-farming Experimental Plots.

Plate No. XXXVI.

Some Chemical Reflections concerning Lamziekte.

By ARTHUR STEAD, B.Sc., F.C.S., Department of Public Health, Bloemfontein, Orange Free State.

LAMZIEKTE is a disease that can be accounted for in many plausible ways, not the least ingenious of which is the accumulative poison theory so ably and lucidly advanced by Dr. Theiler in recent numbers of the *Agricultural Journal*. No doubt the conclusions of Ostertag and Zuntz with regard to "pica" had much to do with the formulation of this theory, which I consider is open to much objection from a chemical point of view. Moreover, the conclusions of Ostertag and Zuntz themselves are open to no little objection. Let me take one instance. They found that the "pica" vegetation contained too little sodium and too much potassium. In order to rectify this abnormality they applied a sodium manure to a portion of the moorland. Unfortunately Chili saltpetre was used, which, besides being a sodium manure, is

(1) a powerful nitrogenous manure;
(2) a very efficient agent in rendering the potash reserves of the soil available for the use of plants.

In practice, then, the application of Chili saltpetre is equivalent to nitrogenous and potash manuring.

Now, Ostertag and Zuntz found that the grass manured with Chili saltpetre was no longer poisonous, from which they concluded that the sodium of the saltpetre was the ameliorating agent; while it should be perfectly plain that the nitrogen of the saltpetre and the potash liberated by the saltpetre could be equally well and in more probability held accountable for the improvement. Strange to say, this view is corroborated by a further observation of these workers. They found that clover grown on the moorlands did not produce the disease. If their reasoning were correct we should expect clover to contain little potassium and much sodium; but the contrary is the case: clover contains quite thirty times as much potassium as sodium. Further, clover is a crop which is independent of soil nitrogen, because it is able to and does obtain nitrogen from the air by means of certain bacteria which live in symbiosis with it. It only remains to point out that to grow a crop which is independent of soil nitrogen is to dispense with the need for nitrogenous manuring which the experience with saltpetre would suggest to be necessary in the case of the moorland grass crop. Let us now turn to lamziekte. On page 86 of his pamphlet Dr. Theiler ascribes the quiesence of the disease in winter to an increased breaking down of the muscular tissue in which the hypothetical vegetable poisons are supposed to have accumulated. If this be granted it would appear that the only preventive measures necessary are (1) to starve our animals when the disease is prevalent, or (2) keep them on a protein-deficient diet; either of which courses would compel them to draw upon their muscular tissue for missing substances that are necessary for the

continuance of the processes of life. This would break down the muscular tissue with a vengeance and destroy the poisonous accumulations if any were there. But this is absurd, as I shall now demonstrate. Consider a cow in milk. Even if stall-fed she scarcely ever receives sufficient of the flesh-forming proteins in her food. Such an animal makes inroads upon her own substance to supply the elements that are lacking in her food, but which she must have in order to produce milk for her calf. For this reason one scarcely ever sees good milkers whose condition is not on the "under-side." Therefore, in general with heavy milkers, there is always a very considerable breaking down of the muscular tissue which, according to theory, should destroy the accumulations of lamziekte poisons. Such animals should not therefore be liable to the disease. We all know that the contrary is the case; indeed, such animals are very susceptible. Perhaps the most susceptible of all animals is the young cow just prior to or just after calving. Concurrent with this increased susceptibility to attack is an immense and sudden demand for protein for the purpose of forming the "colostrum." The animal cannot get this protein from her own food so must perforce abstract it, like a starving animal, from her own flesh and blood. At this time, therefore, there must be a maximum breaking down of the muscular tissue, together with a simultaneous destruction of lamziekte poisons, which should confer a maximum degree of immunity. It is plain that the accumulative poison theory cannot be regarded as giving any explanation of the incidence of the disease or its quiescence in winter. To emphasize how excessive this call for protein is the figures of Droop Richmond for normal milk and "colostrum" are here given, side by side:—

	Normal Milk.	Colostrum Milk.
Fat	3·9 %	3·37 %
Sugar	4·75 %	2·48 %
Ash	0·75 %	1·78 %
Protein	3.40 %	20·68 %

(The high figure for "ash" in colostrum is worthy of note.)
It is only reasonable to suppose that this excessive demand for protein is in some way connected with the increased susceptibility at this period. The extra demand for ash constituents is also interesting, because susceptible animals are just those which require relatively large amounts of "ash" ingredients and protein. These animals are heifers, tollies, weaned calves, cows in milk or about to calve, especially young cows. In passing be it noted that sucking calves which also require much ash and protein are immune. The want-of-nutrition theory has been discarded principally on this account. It was asked, "How can the cow give the calf what she lacks herself?" I shall now explain how this is possible. But first of all I would ask, "Does the sucking calf need the lacking elements and is it only when the calf comes to digest solely vegetable complexes that these missing substances are necessary?" If the answer to the latter question be in the affirmative, there is no need to pursue the matter further; if in the negative, I would reply that the cow cannot help secreting them in her milk. The production of milk is a function of the milk glands, which manufacture the constituents of milk from the constituents of the blood. Because of this the composition of milk is practically unaffected for any length of time by variations in diet.

The composition of milk like that, say, of saliva or urine is fixed for each individual animal within fairly narrow limits. Therefore, although a cow may be receiving insufficient protein, lime, or phosphorus in her food, Nature has arranged that the calf shall not suffer; the cow supplies the deficiencies from her own flesh and blood. There is, however, a limit which, if exceeded, the mother dies.

Now, can immunity in winter be explained? If the food requirements of animals in winter and summer be compared, a gleam of light will be found. In winter it is cold; therefore the animal has to produce more heat to maintain its body temperature. In winter animals exercise more; exercise is work; work is the production of heat; therefore, for two reasons the animal requires more heat-producing substances in winter than in summer. Now, carbohydrates and fats are the heat-producing constituents of foods. Therefore it comes to this, that an animal requires in winter a greater proportion of carbohydrates and fats than in summer. A trek-ox, whether it be winter or summer, requires plenty of carbohydrate or fat in its food, for these are the work-producing constituents of foods. Therefore, at such times as animals are immune, they require larger proportions of carbohydrates and fats in their rations. The question therefore arises, "Does the herbage of the veld, when lamziekte is prevalent, contain an undue proportion of carbohydrate together with a notable deficiency of proteids, the nitrogenous-sulphur constituents of plants?" Only laborious chemical investigation can give a conclusive answer; my belief is that such a condition prevails. Anyhow, we know that the smaller the protein requirements the less susceptible the animal.

It is convenient, at this point, to discuss the action of bone-meal. There is not the least shadow of doubt that bone-meal properly and regularly administered is an efficient preventive. How it acts has not yet received a complete explanation. Probably, as Dr. Theiler seems to suggest, it is an "activator of something else." It is also, probably, to some extent a food. Be this as it may, it is established beyond doubt that the constituents of bone-meal are essential constituents of the food of animals. This has been proved in many ways, of which the following can be taken as typical. Wheat-bran is treated with water to remove phytin, an organic compound rich in lime and phosphoric acid, which are in amount the two principal constituents of bone. The residue, which contains hardly any lime or phosphorus, is mixed with wheat-gluten and rice, also very deficient in these essential substances. A little sugar is added to make the mixture palatable, and a few other essential substances that get removed in the washing along with the phytin. The resulting mixture provides a very nourishing food, except that it is very deficient in lime and phosphoric acid. Such a mixture is fed to pigs with and without the addition of phosphate of lime. For a considerable time all animals thrive well (compare the first few months of fresh cattle in lamziekte country); but eventually those not receiving phosphate of lime fall off in condition and finally lose all appetite and the use of the hindquarters; while those that receive phosphate of lime remain in perfect health. Such an experiment shows that animals can consume food tha' is vitally deficient in certain elements and yet thrive for a considerable time. It also shows that a food deficiency of lime and phosphoric acid can be made good

artificially, and for a time, by the animal's own reserves, i.e. its own bones. The experiment also suggests that the withholding of phosphate of lime affects not only the bones but the entire system as well. (In passing I would point out that bone contains other substances than lime and phosphoric acid; it contains a notable quantity of fat and also of protein. The manure merchant often extracts these substances for the purpose of obtaining bone-oil and glue, so that the bone-meal of commerce sometimes contains its proper quantity of fat and protein and sometimes not. Perhaps the difference of opinion that appears to exist with regard to the value of bone-meal as a preventive in lamziekte may be due to the fact that one farmer has used unextracted bone while another has used the extracted variety.)

Natural bone, because it contains fat and protein, must be considered as possessing considerable food value; similarly the bony skeleton of an animal must be regarded as an enormous food reserve on which the animal can make inroads in case of need. Now, all will admit that the circulation of the blood is increased by exercise. I would ask, "Does the increased circulation due to exercise result in an increased searching of the bony skeleton for its nutritive reserves?" It is reasonable to suppose so. Reasoning thus, it is not difficult to understand why, apart from the reason given above when discussing the food requirements of animals in winter and summer, that exercise is a preventive of lamziekte. Exercise enables the animal to make the best possible use of its reserve materials.

In conjunction with bone-meal it is natural to consider the statements that lamziekte is prevalent on soils that are porous and sandy, while the disease is unknown on the deep and more retentive types of soil. Many years ago Dr. Juritz in the Cape pointed out that the soils of certain lamziekte areas were remarkably deficient in lime and phosphoric acid. I would here point out that in times of drought soils well stocked in these respects are, so far as the plant-life on them is concerned, also deficient; because an adequate supply of moisture is essential to permit of the absorption by the plant of the phosphate of lime. The Rothamsted experiments have taught us that the plant is still seeking phosphoric acid when all else has been gathered; that, in consequence of this, manuring with soluble phosphates hastens the maturity of crops in a remarkable manner. It is plain that in cases of prematurity owing to drought, however short of other substances the plant may be, it will be worst off in respect of phosphoric acid. Now, lamziekte appears to be most prevalent at such times as sun and hot wind kill the grass that had begun to grow owing to the stimulus of a shower of rain, that is, at such times as the growth of the grass had been brought to a premature standstill (compare wilted-grass theory). Frost also stops growth, and in this respect is the equivalent of drought and hot wind. For this reason, from a lamziekte point of view, vegetation killed prematurely by frost has the same properties as that killed prematurely by drought. Thus it happens that late rains do not always stop outbreaks of the disease, because the grass gets killed prematurely by frost. Whether killed by sudden drought or frost, lamziekte grass is certainly most deficient in respect of phosphoric acid or substances which it manufactures by its aid, which substances are presumed to be of vital import to the animal. Further, is it not possible that these vital substances (vitamines, they are called) can

be elaborated in the animal's own body provided the supply of phosphate is adequate, whether in the shape of its own bones or of some other animal's bones? Whatever the explanation be, we have the fact that a lack of phosphates in food will produce, after a time, the symptoms of serious disease which do not arise if some artificial form of phosphate is fed. This brings me to the consideration of the type of vegetation that ensures immunity. First of all, there is the gannabos. It is

(1) a lime indicator;
(2) an indicator of "alkali" and therefore of a soil rich in soluble plant-food materials;
(3) a deep-rooting drought-resisting plant which, to a great extent, is independent of frequent rains.

With this and similar species there can be no question of deficiencies caused by immaturity or prematurity due to drought or frost as in the case of the much less resistant grasses that grow on poor or porous soils. Further, cultivated crops and products made from them (lucerne, forage, bran, green barley, wheat, etc.) are known to be efficacious in preventing and arresting outbreaks of lamziekte. Lucerne, like ganna, is very deep-rooting and thrives on rich soil only; while in the case of all of the crops mentioned a sufficient supply of water is assured either by planting when rain is sufficiently abundant or by irrigation. Pretoria grass is even a case in point; it is as a rule produced under much more favourable moisture conditions than the grass of lamziekte districts. Then take the banks of the Modder River, which are said to afford "safe" veld. Here the soils are deep and rich, also somewhat brack, and supporting a deep-rooting vegetation. Again there can be no question of prematurity likely to have any vital effect on the consuming animal. I now return to the deficiency-of-protein suggestion. It is important to know whether any diseases have been overcome by improving a protein-deficient diet. Such is actually the case. For example, I give beriberi, the scourge of the East, because it has many points in common with lamziekte. This disease was practically stamped out of the Japanese navy by simply providing the seamen with extra protein in their diet. Prior to the change no less than one sailor in four was attacked; subsequent thereto the proportion attacked fell to the very small figure of one in ten thousand. Of course the fact must not be overlooked that the substances employed for adding protein may have contained certain vital compounds not contained in the ordinary diet of the Japanese seamen; even so, we have here the clear case of a protein-deficient diet causing disease while a diet containing a larger proportion of protein kept the disease away. We also know that lamziekte does not occur in cattle receiving a liberal proportion of protein in their food.

There are other notable likenesses between beriberi and lamziekte which have led me to suspect that there is some close relationship between the two diseases. For instance, an attack of beriberi does not confer the slightest degree of immunity; on the contrary, a person once having been attacked is all the more liable to subsequent attacks. Notwithstanding this many have described the disease as one of bacterial origin and even claim to have transmitted the disease by inoculation. Others again have regarded the disease as a toxemia (a blood-poisoning).

Like lamziekte, beriberi is endemic; that is to say, it is peculiar to certain districts and even farms (plantations as they are called in the East). Beriberi attacks the most fit in condition, but hardly ever the very young or old, with which exceptions it attacks persons of all ages, especially those that lead a sedentary life and particularly pregnant and parturient females. Epidemics occur in the hot season, while during the winter months cases are of rare occurrence. When cases arose, the first steps in treatment were to remove the patient from the place where the disease was contracted and to improve the diet, viz., to give food containing a greater proportion of protein. Further, in beriberi there is no temperature and the appetite is generally good.

I am sure that most people will agree that the features of beriberi outlined above are remarkably similar to those of lamziekte. It is therefore worth our while to consider somewhat closely some recent chemical work that has discovered the cause of beriberi, a disease of great antiquity and one which had baffled the efforts of highly qualified medical and scientific men. Rice eating was known to be in some way connected with this hitherto inexplicable disease; then later it was found that polished rice produced the disease while unpolished rice did not; it was also found that polished rice did not cause the disease if the polishings were eaten with it. This plainly showed that the outer coats of rice contained something that protected one from attack. This led to the chemical investigation of the polished and unpolished grain and also of the polishings, with the result that the polishings were found to be rich in phosphoric acid, while the polished grain was very deficient. It was then found that rice which did not contain less than 0.4 per cent. of phosphoric acid was safe. Nevertheless, the phosphoric acid is not directly the protecting agent, as quite recently a chemist named Funk has proved.

Funk succeeded in isolating the protective and curative substance which on analysis was found not to contain any phosphorus. Further, he estimated than 10,000 parts of rice contained only one part of "protective" substance. Of this "protective" substance a very small quantity is a curative dose. It is almost unbelievable that such a small fraction of the grain can be endowed with such vital properties. It is nevertheless perfectly true. Also a similar "protective substance" has within the last few months been isolated from brewers' yeast by Professor Moore, Edie, and others at the Liverpool University. This substance, although not containing phosphoric acid, occurs in conjunction with it, owing to which fact it is believed that phosphoric acid is in some way not yet understood responsible for its formation. Further, milk contains a substance that possesses protective properties, and no doubt before long similar bodies will be found in many other foodstuffs. In view of the foregoing it is only reasonable to suppose that bran, lucerne, green barley, ganna, bosje, etc., are efficacious in preventing lamziekte because they contain "protective" substances. That relatively small quantities of these foodstuffs are able to ward off the disease we can now understand in view of the fact that the total amount of "protective" substance in rice is so extremely small, while there is no reason to believe that large quantities of "protective" substance are required in the case of lamziekte. If, as I firmly believe, lamziekte is a disease caused by the absence of "protective" substance from lamziekte vegetation, the day is not far off when the farmer will be able to carry a cure

for it in his waistcoat pocket. Of course much work will have to be done before the "protective" substance is isolated; but once this has been done the commercial preparation of it is bound to follow. In the meantime we must patiently await the chemical attack on this disease, an attack which I trust will not be long delayed. Now the farmer is always on the outlook for tips as to how he should experiment. I do not think he could do better than try the effect of liberal doses of brewers' yeast or even of kaffir beer or other fermented liquor; because, since an extract of yeast cures the symptoms of beriberi, it is likely that yeast itself will cure the disease, and diseases of a similar nature, like lamziekte. Milk is also a possible curative agent. More than this I cannot say at present.

In conclusion, I would point out that after all there is not much difference of opinion between me and those who believe in the toxin theory. We all agree that the vegetation is the cause; I, because I believe it is vitally deficient; while others believe it to be actually poisonous.

Scab in Sheep and Goats.

DIPPING AND DIPPING MATERIALS.

By B. G. L. ENSLIN, Chief, Division of Sheep.

THE purpose of this article is not to furnish the sheep farmer with information regarding the disease known as scab—*that* has already been done in an article published by Mr. A. G. Davison, Principal Inspector of Sheep, in the February, 1912, issue of this *Journal*—but to offer a few remarks on the methods to be adopted for the eradication of the disease. It may be urged that every sheepman who knows his business knows how to cleanse his flock from scab, but the continuance of that disease in every district of the Union goes to show that the information available on this subject is not so complete as could be desired.

DIPPING TANKS.

In the first place, every farmer who possesses sheep or goats should have on his farm a properly constructed dipping tank of a permanent nature, with suitable catching and draining kraals adjoining it. It has frequently been urged by farmers that their sheep have been free from scab for years, and as they do not intend keeping scabby sheep, they do not see the necessity of going to the expense of constructing a tank. A moment's reflection will prove to them that they are wrong; for it is necessary to dip sheep not only for scab but also for lice and ticks, which in their way do a great deal of harm, particularly the latter parasites, which serve as hosts for the transmission of all sorts of diseases and troubles such as heartwater, etc.

Before providing himself with a dipping tank, it is well for the farmer to know that by dipping is meant the total submersion of each animal in the dip, and its retention in the fluid for a period of two minutes during each of the two dippings required by law and not the hand-dressing which so many farmers persist in regarding as sufficient. It will, therefore, be clear that dipping tanks must be so constructed as to admit of the total submersion of a large sized sheep or goat. As tanks not so constructed give more labour and less efficiency, they will not be regarded as sufficient compliance with the Minister's order in connection with the construction of sheep dipping tanks (as published under Government Notice No. 1748 of 1911, and as amended by Government Notice No. 2107 of 1911). Farmers who have not yet complied with the above Minister's order will be well advised to consider the construction of a circular tank (without a pillar in the centre) such as that recommended by the Department in Bulletin No. 7 of 1912 which, together with the necessary plans and specifications, may be obtained on application to the Sheep Division.

In the above Bulletin a description of a long tank is also given but a circular tank is specially recommended for the following reasons :—

(*a*) It is cheaper to build ;

(*b*) it is more economical in the consumption of dipping material : and

(*c*) it will give better results with much less labour in dipping because the sheep can be kept swimming the full period of its immersion (which has a most beneficial effect in that, by its movement when swimming, the fleece is opened and the dipping mixture has a better chance of penetrating to the skin), whereas in the long narrow tanks usually found in South Africa this is not possible, as a sheep takes only from half a minute to one minute to swim through, when it must either be pushed or held back in order to keep it immersed for the required two minutes. This pushing or holding back involves a great deal of labour and when more than one sheep is placed in the tank at the same time, as is generally done, the sheep climb on top of one another and can only be held back and immersed with the greatest difficulty. The shoulders and back of the sheep being out of the dip most of the time are not properly saturated with the dip, or the sheep are allowed to leave the tank as soon as they have reached the outlet (which only takes about half a minute) the result being that the farmer fails to cleanse his sheep and ends up by condemning dipping as ineffective.

It will be said, surely farmers are not so blind to their own interests as to dip sheep in such an ineffective manner, but there is not the slightest doubt that such things do happen and unfortunately only too frequently.

The Division of Sheep is busy preparing a plan of a circular tank with a slide by which the sheep will slip into the tank without being handled. This will still further reduce handling, and make the dipping of sheep easy instead of laborious as at present.

Owing to the large amount of dip which is required for a long tank with a fifty or sixty feet swim, it is only justified where farmers have flocks comprising seven thousand or more sheep. For economy combined with efficiency the circular tank is undoubtedly the one for the small farmer.

It is regretted that so many farmers with fairly large flocks go in for hand-dips—no wonder that dipping is looked upon with so much disfavour, for a more laborious and wasteful way of cleansing sheep than the use of one of these tanks cannot be conceived. The only case in which a hand-dip is justified is when the owner of a farm who has been exempted from the Minister's order for the construction of a tank, because he does not farm with sheep, refuses to build one for his tenant.

Tenants will be well advised to look round before purchasing portable tanks, as good portable tanks, more or less on the circular tank principle can be obtained for reasonable prices.

DIPPING MATERIALS.

The choice of a dip is the next thing to be considered: In choosing this the farmer should remember that the basis of all good dips is sulphur, for sulphur is probably the best of all known insecticides; more especially is this the case in dealing with sheep parasites for it will remain in the wool for months after its administration.

The problem the farmer is faced with is how to kill the parasites. There are many patent and proprietary dips prepared to-day which may or may not be capable of doing all that is claimed for them. There are good ones and bad ones and the best motto in buying dip—and other things—is *caveat emptor* (let the purchaser be aware). Buy a patent or proprietary dip if you think it will serve your purpose, but at least take the trouble to know what you are buying; otherwise you may find that you have spent money in dipping your flock in a useless preparation and your labour will be lost. Refuse to purchase any ready-made dip which does not bear on each package a printed statement of its ingredients and their proportions. It would be foolish to condemn any dip merely because it is readymade, but still the value of home-made dips cannot be too strongly insisted upon, for scab was eradicated in Australia by these same home-made dips.

Lime and sulphur, and caustic soda and sulphur are two home-made dips particularly recommended by the Division for the eradication of scab for which purpose they are certainly two of the most reliable dips.

LIME AND SULPHUR AND CAUSTIC SODA AND SULPHUR.

The Department of Agriculture has prepared the following formulae for the use of these specifics, and if the directions are not understood the local sheep inspectors have instructions to show farmers how to prepare them.

(a) *Directions for the use of Sulphur and Lime as a Dip for Sheep and Goats.*

(1) Take 25 lb. of well sifted sulphur and 20 lb. of slaked lime, or 15 lb. of unslaked lime (the latter preferable); add 3 or 4 gallons of water to the lime and mix thoroughly with the sulphur into a paste.

(2) Throw the mixture into a pot containing 25 or 30 gallons of boiling water and allow this to remain boiling for from 30 to 40 minutes, until a dark purple scum rises to the surface.

(3) The water and sediment should then be taken from the pot and thrown into a tub (placed on the side of the dipping tank) with a bung-hole 4 inches from the bottom; when the sediment has well settled down the pure fluid may be run off into the tank and the refuse thrown away.

(4) For every 25 lb. of sulphur and 15 or 20 lb. of lime, 100 gallons of clean water must be added, and it is desirable (though not altogether essential) that the temperature of the water in the tank be maintained at a lukewarm heat throughout the operation of dipping.

(5) Great care must be taken to prevent any sediment being thrown into the tank.

(6) In order to obtain the best possible results when cleansing sheep with the sulphur and lime dip it is absolutely necessary that the lime should be freshly and thoroughly burned and slaked only when it is required for dipping purposes. In this state it consists of almost pure calcic oxide, but on exposure to the air at any time this calcic oxide (essential for the thorough dissolving of the sulphur) becomes changed into calcic carbonate, which does not combine with sulphur to form the soluble sulphides required.

This dip is recommended not only on account of its economy and safety, but also for its curative as well as preventive properties.

(b) *Directions for the Preparation of Sulphur and Loogas.*

(1) Take 25 lb. of well sifted sulphur and 25 lb. of powdered loogas, mix the same thoroughly together when in a dry state, add sufficient water and mix the ingredients into a paste.

(2) Throw the mixture into a pot containing 25 or 30 gallons of boiling water and allow this to remain boiling for from 20 to 25 minutes.

(3) The water and sediment should then be taken from the pot and thrown into a tub (placed at the side of the dipping tank) with a bunghole 4 inches from the bottom; when the sediment has well settled down the pure liquid may be run off into the tank and the refuse thrown away.

(4) For every 25 lb. of sulphur and 25 lb. of loogas 100 gallons of clean water may be added, and it is desirable (though not altogether essential) that the temperature of the water in the tank be maintained at a lukewarm heat throughout the operation of dipping.

(5) Great care must be taken to prevent any sediment being thrown into the tank.

(c) *Directions for the use of Caustic Soda and Sulphur.*

Take 5 lb. caustic soda (Thistle brand), 98.99 per cent.; 20 lb. sulphur; 100 gallons of water.

Mix the sulphur with enough hot water to form a thin cream (when mixing the sulphur into a paste, not more than 2½ gallons of hot water should be used; if mixed into too thin a paste the soda does not boil readily). Then sprinkle the caustic soda slowly into the cream, stirring the mixture thoroughly until all the soda is in. In 40 minutes the resulting fluid can be poured into the 100 gallons of water. The ingredients necessary to make a larger quantity than 100 gallons of dip should not be mixed in bulk. If for instance 1000 gallons of dip are required, ten lots should be made as above. Mixing in bulk is liable to result in the materials becoming caked and not properly dissolved. All lumps in the sulphur should be carefully broken up. Sheep should be kept in the dip two minutes, and goats three minutes. When pouring the caustic soda into the sulphur cream, always stand above the wind.

The mixture should on no account be boiled.

It has been stated that lime and sulphur, and caustic soda and sulphur will cause blood-poisoning in "shear-cut" sheep. No proof has

yet been given of this statement, and in view of the thousands of sheep and goats dipped annually under the supervision of the inspectors, in these specifics, without loss the Department is inclined to attribute the blood-poisoning which has occurred in isolated instances to septic influences such as the use of uncleansed tanks, stale dip, foreign matter, etc.

The Bureau of Animal Industry of the United States Department of Agriculture tried the experiment of injecting 5 c.c. of a clear lime and sulphur dip (their formula No. 6) under the skin of a sheep, without producing any evil effects. The only valid objection which any farmer can possibly have against these two dips is that they take a little trouble to make. Having regard to their efficiency and cheapness, however, farmers would do well to take the trouble involved in preparing these specifics rather than to use dips soluble in cold water which are not so efficacious.

METHOD OF DIPPING.

In the first place it may be well to remind farmers it is required by law that every scab infected flock be twice dipped in an efficient scab destroying preparation within a period of not less than ten nor more than fourteen days, and that if one sheep in a flock is infected then the whole of the flock is infected, and every flock which comes in contact with an infected flock or grazes over the same ground or is watered at the same place is likewise infected, and so too is any flock placed in a kraal or allowed to graze over land which has been used by infected sheep and has not subsequently been burnt, disinfected, or declared clean by a sheep inspector. If goats are running with sheep they must be dipped with the rest of the flock.

It is, therefore, clearly the farmer's first duty to see that all the animals in an infected flock are dipped. To leave the goats and lambs of an infected flock undipped simply because they are not visibly infected with the disease is, besides being a contravention of the law, very foolish, for in all probability the farmer will have again to incur, in a very short time, the expense of two further dippings of his sheep, which have been re-infected by the undipped lambs or goats. It is a well-known fact that animals are often in the first stage of infection without showing visible signs of the disease, and that the sheep scab parasite (*Psoroptes communis*, variety *Ovis*) is frequently found on the goat, although it does not thrive on that animal. One undipped animal can easily re-infect a whole flock in a very short time.

As too much care cannot be bestowed upon the dipping of sheep, if loss and failure are to be avoided, the attention of farmers is requested to the following :—

(*a*) Exercise the greatest care in using the dip which has been selected and see that it is prepared strictly in accordance with the directions; to attempt to economize by reducing the quantity of the dip or by guessing the capacity of the tank is to court certain failure; to increase the quantities will be to cure the scab either by killing or injuring the sheep.

(*b*) Be sure when dipping sheep that each animal is thoroughly saturated and kept in the dipping fluid for two minutes by the watch or preferably by the sand glass. *Do not guess the time.*

(*c*) Take care that every animal is placed hind quarters first in the tank, which must not be overcrowded. By throwing sheep head foremost there is danger of the fluid getting into the lungs and causing inflammation, which usually results in the death of the animal.

(*d*) In dipping sheep in low condition they must be carefully handled and assisted in getting out of the tank, and on no account must the tank be overcrowded.

(*e*) If it should become necessary, on account of an outbreak of scab, to dip sheep in winter, a suitably warm day should be selected and all operations be suspended by about midday to allow of all the fleeces drying before sunset. If dipping be carried on after midday there is danger of the sheep which have not had an opportunity of drying, perishing with cold.

(*f*) When dipping pregnant ewes treat them in a rational manner, lifting them into the tank with care and removing them with the same care. Do not *drag* them to the tank by their hind legs—there is no more fruitful cause of abortion than dragging pregnant ewes about by their hind quarters.

(*g*) If possible, use a dip which can be administered for the second time on the tenth day after the first dipping without danger of loss, but do not in any case allow more than *fourteen* days to elapse from the date of the first dipping before administering the second dipping. Be careful to dress all patches of visible scab with dip before immersing the sheep. A non-poisonous ointment for dressing the crusts may be made by mixing four ounces of turpentine with six ounces of flowers of sulphur and one pound of lard. Mix the ingredients at a gentle heat and rub the mixture in well with the hands or a brush, at the same time thoroughly breaking up all hard scabs.

DETAILED DIRECTIONS FOR THE TREATMENT OF INFECTED GOATS.

To ensure the complete and successful cure of goat scab, especially when animals are infected with the sarcoptic variety (commonly called boer goat scab) which burrows under the epidermis, the following directions should be closely followed :—

(*a*) Prepare the sulphur and lime or caustic soda and sulphur in the manner directed, and measure carefully all water put into the tank. It is most important that the dipping mixture should be neither too weak nor too strong, and should always be used in a warm state.

(*b*) Take all animals which are visibly infected and give them a distinctive paint mark ; then scrub all the scabby parts with some of the mixture from the tank. It is of the greatest importance that all hard scab should be broken up and thoroughly softened before the animal is placed in the tank, otherwise the dipping mixture will not penetrate to the skin in a satisfactory manner.

(*c*) When all the scabby animals have been well washed and scrubbed, place all the goats in the flock carefully in the tank and allow them to remain there for at least three minutes.

(*d*) The day following the dipping, take all the paint-marked goats and apply *pure lard oil* to any infected spot. If the goats are affected with the scab about the head, pay particular attention to such places and rub the oil thoroughly over the whole face, lips, ears, jaws, and under the gullet.

(*e*) About six days after the dipping again catch the paint-marked goats, and if necessary give another application of pure lard oil.

(*f*) Repeat the dipping of all goats in the flock within from ten to fourteen days of the first dipping, and a day or two after again apply oil to all paint-marked animals.

(*g*) Between the first and second dippings the goats must be placed in a new kraal or sleeping place.

(*h*) When kids of either Angora or other goats are being dipped, it is most important that they should be placed in the tank before the full-grown or stronger animals are treated. When the heads of the kids are submerged, this should only be done when the mouth of the animal is closed by hand and held in this manner until the kid again comes to the surface. The greatest care should be taken that none of the dipping mixture enters the mouth of the animal, as with the constant bleating, the water may enter the lungs and thus cause death.

TREATMENT OF INFECTED KRAALS.

As experiments made by Mr. Davison in the Cape have conclusively proved that a kraal retained the germs of infection after a period of three years, it is essential that all kraals and sleeping places be thoroughly cleansed at the same time as the sheep are being dipped. To dip sheep and turn them into infected kraals simply prolongs the disease, and increases the expense of cleansing.

The law demands that all kraals, sleeping places, sheds, and other premises in which infected sheep have been kept shall be burned or otherwise disinfected, or enclosed by the owner to the satisfaction of an inspector. The best means of cleansing a kraal is undoubtedly by fire, but in cases where it is unsafe to do this, the fencing-off of the infected kraal, etc., or the disinfection thereof (spraying with a 5 per cent. solution of carbolic acid and subsequently lime washing) will be permitted. Disinfecting can, however, only be practicably resorted to in the treatment of sheds or pens. The operation would in other cases be too costly and consequently out of the question, and to spray infected kraals in which there is a large accumulation of dung is impracticable in that, unless a very large quantity of the fluid is used, the dung will not be saturated.

In kraals built of stone or any material which will not burn the best means to adopt is either to dig up the manure and burn it or take it away to the lands. When the manure has been removed to the lands—a course which should always be adopted in preference to burning it—straw, grass, or bush should be laid on the floor and against the walls of the kraal, and burnt. In the case of bush kraals owners should remove the bush and build a kraal on a clean spot, or burn it. The floors of such kraals should be dealt with in the same manner as stone kraals should. Kraals of which the walls are made of dung cakes should be burnt or if it is desired to use the dung for household purposes, the dung should be stored in a shed or an enclosure within which stock cannot trespass.

The fencing-off of kraals should only be undertaken when they cannot be dealt with in the manner described above. Open sleeping places are certainly the most difficult to treat and in a good many cases will not admit of any treatment; when such treatment is possible they should be covered with bush or grass and burnt, and in cases where such a course is impossible it may be advisable either to plough the ground up or to fence the sleeping places off whichever may be found practicable.

By carefully treating infected flocks and kraals in the above manner there is no reason why scab should not be eradicated at an early date, but

it is on account of the failure to carry out all of the above precautions that scab is still prevalent in every Province of the Union.

When a farmer has once cleansed his stock and farm, he should take every possible precaution to guard against re-infection. One of the best precautions for a farmer to adopt is to prevent sheep coming from other farms being mixed with his own, before they have been dipped. The sheep and the farm from which the sheep come may have been clean for years, but there is always danger of picking up infection on the road.

The Construction of Modern Silos.

By A. MORRISON HAY.

IN form a silo may be built either square, rectangular, octagonal, or circular on plan. If forming part of a scheme of buildings its shape would probably be decided by the position it occupied and the space available, but if standing alone either form could be adopted at will. The round silo is more favourable to the even and compact settling of the silage owing to the absence of corners, and, consequently, more favourable to its perfect preservation. On the other hand, it does not fit in with other buildings so readily as a square or rectangular silo without loss of space, and for this reason the latter are likely to be more frequently built. The same remarks would also apply to octagonal silos. If standing alone, however, no objection can be raised either to the round or the octagonal form of silo, and as the proper preservation of the silage is the main object to be attained, one or other of these forms should be adopted in preference to the others. The main objection to square or rectangular silos is the presence of corners, which prevent the silage from settling uniformly and compactly, thus causing waste of space and creating undesirable accumulations of air. This defect may be remedied to a considerable extent by having the corners well rounded. Of the two, the square silo is perhaps the better form, and probably somewhat cheaper than a rectangular one of equal capacity, as the wall space is rather less.

Where a large quantity of silage is required it is advisable to have it stored in two or more moderately sized silos in preference to one very large one. With very large silos too much surface of silage is exposed while feeding; and, if the height is increased to modify the surface dimensions beyond a reasonable limit, excessive labour is involved in the working. The height above-ground should not exceed 20 to 25 feet, and the depth under-ground should not be more than 5 or 6 feet, the limit from which a man can conveniently lift the forage. With rectangular silos the difficulty can be obviated by having one or more partitions dividing the silo into two or more square, or nearly square, compartments.

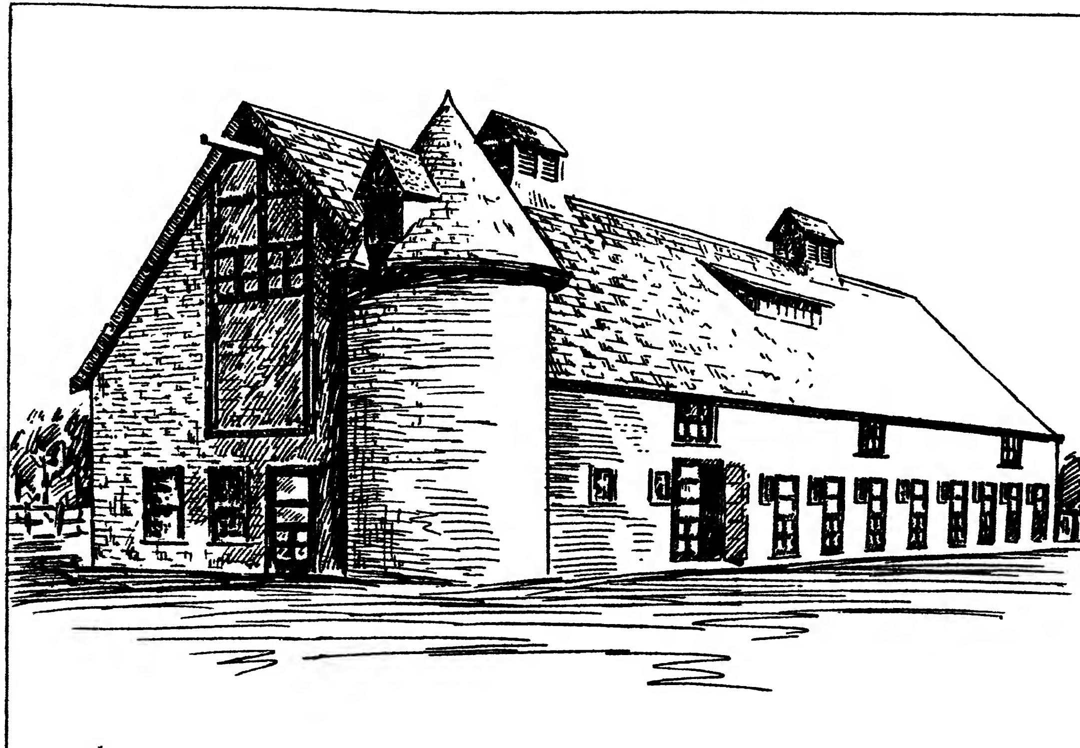


Fig. 1. Round Silo (Minnesota University Experiment Farm).

Whatever form is adopted for the silo, it should always be built with a greater capacity than would be necessary, if it could be filled to the top with good silage, as considerable allowance has to be made for waste from settling and from spoiled silage. Even if material is added a second or third time there will still be a certain amount of waste space to be allowed for. One-fifth is considered a low estimate for loss of space and waste silage.

As a basis on which to ascertain the size of silo necessary to hold food for a certain number of cattle for a certain period of time, 40 lb. may be taken as the average amount of silage required to feed one animal per day, and 40 lb. may also be taken as the average weight of a cubic foot of silage. Therefore, if the number of animals is multiplied by the number of days during which they have to be fed, the result will equal the number of cubic feet of silage space required. Supposing 30 animals have to be fed for six months, or 184 days, the total amount of space required would be 30 × 184 = 5520 cubic feet.

To find the number of cubic feet in a square or rectangular silo multiply the length in feet by the width, and then by the height, and the result will give the total number of cubic feet. Thus, if a square silo measures 14 feet each way on plan and 25 feet in height the cubical contents would be 14 feet × 14 feet × 25 feet = 4900 feet.

In the case of a round silo, multiply the square of the diameter in feet by the height, and then by .7854. For example, if a round silo measures 14 feet in diameter and 25 feet in height, the cubical contents would be 14 feet × 14 feet × 25 feet × .7854 = 3848 feet approximately.

As regards position, the silo should be placed as near as possible to the centre of feeding to minimize the labour of carrying food to the various mangers. In round or octagonal farm buildings, such as are common in America, the silo usually takes the same shape as the main building, and is placed in the centre, where it occupies a convenient position from which to feed the various animals stalled around the building. The accompanying diagram (Fig. 1) shows a circular silo situated at a corner of the main building, where it not only proves a useful adjunct, but also forms a very pleasing feature. A convenient arrangement is to have the doors of the silo opening into a passageway, or into the feed store or mixing room, which usually occupies a central position. A saving in the cost of erection can often be effected by utilizing one or more of the walls of the main building in the construction of the silo.

The material to be used in the construction of a silo would probably be decided by local conditions. The most readily obtained in the locality in which the silo is to be built would naturally be chosen, provided it fulfils the conditions required for a good silo. Metal has been tried in some countries, but has not been found satisfactory on account of the initial cost and the readiness with which it yields to the coroding action of the silage juices. In America, wood has hitherto been very largely used in the construction of silos, on account of the abundance of timber in that country and the comparative ease and cheapness of erection, and wood is considered one of the best materials for the preservation of silage. It is not likely, however, to be much used in this country on account of its scarcity and want of durability.

For durability either reinforced concrete, stone, or brick, or a combination of these materials is to be recommended. Reinforced concrete is probably the best material, especially for circular silos, but requires more skilled labour in the construction, and is consequently more costly. Stone or brick structures require less skill in building, and as either one or other of these materials can usually be readily obtained throughout the Union, they are likely to enter more largely into the construction of farm silos.

Whatever material is used—whether concrete, stone, brick, or wood—the foundation should always be of some material that is not subject to early decay, more particularly if it extends for some depth below the surface of the ground. In a dry soil a good quality of brick or stone built with lime mortar is sufficient, but if there is a tendency to dampness, either cement concrete or stone, built with cement mortar and plastered on the outside with any damp-proof composition, forms the best foundation. It is important that the foundation should go down to a solid bottom, and it should extend a few inches above the highest point of the ground, and be covered on top with a damp-proof course to prevent moisture from rising to the structure above.

If the silo is built on a soil that is dry all the year round no other floor is necessary. Broken stones might be laid over the floor to a depth of 6 to 8 inches, and then covered with a layer of clean, dry earth or ant-heap, and rolled or rammed till a compact and even surface is formed. Such a floor could only be used where the ground is sufficiently dry and where there is no danger of destructive insects or vermin entering through the floor. In other cases a floor of cement concrete should be laid, 4 to 6 inches thick, on a bed of broken stones, as above described, and tile-pipe drains might also be put in to carry off the water to some lower level.

The thickness of the walls depends greatly on the material used in the construction and the size of the silo. The larger and deeper the silo the greater is the pressure on the walls, and with an increase of pressure there must be a corresponding increase in the thickness of the walls. For a silo of the capacity referred to in the preceding pages, built with stone, the walls should be at least 22 inches thick at the base, but may be diminished to 16 inches at the top, where the pressure is considerably less. If built with brick, the thickness might be 22 inches, or 2½ bricks, at the bottom, diminishing to 14 inches, or 1½ brick, at the top. Stout hoop-iron bands or iron rods are frequently built into the walls to strengthen them, particularly near the doors, where the proximity of so many openings tends to weaken the masonry. If built of reinforced concrete a thickness of 6 inches for the full height is sufficient.

To facilitate the settling of the silage the inside of the walls should be plastered to a perfectly smooth and even surface, with a good thick coating of cement plaster, which must be of the very best quality, and well put on, as the acids in the silage are apt to soften it and cause it to crumble away. The outside face of the walls should be plastered with lime or cement plaster if built with an inferior quality of bricks, but if a good class of bricks is used in the construction they may be left exposed, the joints only being filled up or pointed with lime or cement mortar. In the case of stone walls the joints between the stones should be raked out and pointed with cement mortar.

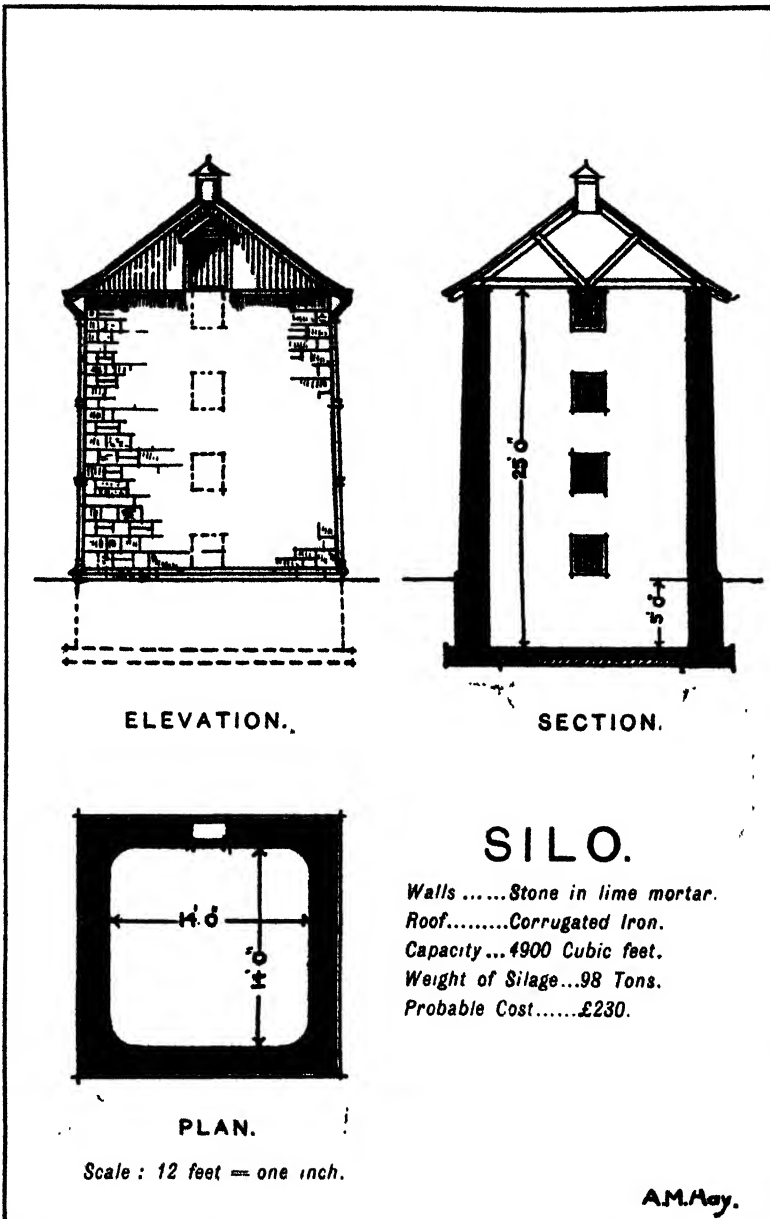


Fig. 2. SQUARE SILO.

Any of the materials in general use may be used for a roof covering, and any form of roof may be adopted, provided adequate provision is made for filling the silo and also for ventilating it during the process of fermentation. The "lean-to" roof does not fulfil these conditions, and is seldom used. The ordinary pitch roof with a gable at either end, or the pyramidal or conical roofs shown on the accompanying diagrams, are undoubtedly the best forms, as they allow for the filling door being placed either in the gable or on the slope of the roof, and also admit of proper ventilation being arranged for. With a roof of corrugated iron, which is the covering most commonly used in this country, the slope of the roof need not be very steep, and the timbers forming the trusses need not exceed 4½ inches × 1½ inch, or 6 inches × 1½ inch at most, according to width of silo. A ventilator should be placed at the apex of the roof, and openings should be formed at the eaves to create a draught and assist in carrying off the foul air and gases rising from the silage.

The doors required for a silo consist of a filling door placed in the gable or in the roof, above the highest point to which the silage is filled, and three or four emptying doors placed one above the other at convenient intervals apart and usually on one side of the building. The filling door should be large enough to freely admit the carrier, say 2 feet 6 inches wide and 3 feet to 4 feet high, according to available space, and should be placed at the side most convenient for filling. The cut fodder is conveyed straight from the cutting machine through the filling door to the centre of the silo by means of a carrier, or an elevating tube up which it is forced by air pressure.

The doors through which the silage is emptied should be about 24 inches wide and 30 inches high, one being at the top and one at or near the level of the ground, and the others spaced at intervals of about 4 feet apart vertically. They should be of well-seasoned timber, strongly made, to resist the excessive pressure and heat, close fitted to exclude all air, and placed flush with the inside face of the wall. The doors may be hinged to the frame, or they may simply be put in place while the silo is being filled, and suspended with chains to the wall when not in use, the former method being perhaps the more satisfactory. To make the doors more perfectly air-tight thick felting is sometimes tacked to the frame, and stout paper is often pasted over the doors for the same purpose.

In most cases it will be found of great advantage to have a vertical chute attached to the silo, down which the silage can fall when emptied from any of the doors. It is made in the form of a long box, extending from near the ground to the top of the silo, and covering the doors. It requires only three sides, the wall of the silo forming the fourth, and should measure about 2 feet 6 inches by 2 feet inside. A ladder running up the full height is fixed inside the chute, giving access to the doors when the silo is being filled or emptied. The lower end may be left open or may be fitted with a sloping bottom to slide the silage into a cart, barrow, or other receptacle used for conveying it to the cattle. A small door can be formed in the front or side to give access to the ladder.

The accompanying diagram (Fig. 2) shows a square silo measuring 14 feet each way on plan and 25 feet in height, and having a capacity of 4900 cubic feet, equal approximately to 98 tons of silage. It is on the lines described in the preceding paragraphs,

built of stone in lime mortar, covered with a roof of corrugated iron, and having a floor of cement concrete 5 feet below the ground level. Four emptying doors are shown on one side and a filling door in the roof. There is a triangular ventilating panel over the filling door and a large ventilator at the apex for escape of foul air, and for the admission of fresh air there is an opening of about 4 inches high between the walls and the roof all round. The inside corners are shown well rounded to facilitate the settling of the silage. Though shown standing alone, it need not necessarily do so, but could be attached to other buildings where found most convenient.

Such a building, if erected by contract at current prices, would cost approximately £230, but a farmer could build it much more cheaply by employing local tradesmen and providing all necessary transport and native labour.

Sugar-cane in South Africa.

By HERBERT J. CHOLES, F.S.S., Department of Agriculture.

(*Continued from page* 204.)

MANURES AND MANURING.

MANURIAL REQUIREMENTS.

IN studying the question of manures for sugar-cane, we may approach the problem from two directions. We may first consider the composition of the canes, and we may then proceed to examine analyses of some typical cane soils. This will serve to give us some idea as to the food requirements of the crop.

In his pamphlet on the Agricultural Chemistry of the Sugar-cane, Dr. T. K. Phipson* states that the average composition of the freely developed sugar-cane is fairly represented by the following analysis:—

	Per cent.	
Water	71.04	Derived almost wholly from the air.
Sugar	18.02	
Cellulose	9.56	
Albuminous matters	0.55	
Fatty and colouring matters	0.35	
Salts soluble in water	0.12	Derived from the soil.
Salts insoluble	0.16	
Silica	0.20	
	100.00	

* Referred to by Newlands.

Taking 1000 tons of cane, therefore, we find that rather less than five tons of mineral ingredients are removed from the soil; in other words, unless the soil can supply this quantity of mineral matter in an assimilable form, a full crop of sugar cannot be expected. As regards nitrogen, about one ton is needed to form the albuminous matter contained in 1000 tons of cane.

Of what does this mineral matter, of which five tons is needed by every thousand tons of cane in order to yield a full crop of sugar, consist? We ascertain this by the study of the ash of the cane. Newlands gives the following as a rough average composition of the ash of the ripe cane and its leaves:—

	Per cent.
Silica	43.0
Phosphoric acid	6.0
Sulphuric acid	8.0
Chlorine	4.5
Lime	10.0
Magnesia	6.5
Potash	18.0
Soda	2.0
Oxide of iron, manganese, and loss in analysis	2.0
	100.0

A comparison of these figures with those contained in other analyses goes to show that the largest mineral requirements of the sugar-cane plant are silica, potash, lime, and phosphoric acid, whilst sulphuric acid and magnesia must not be overlooked. Nitrogen we have already noticed.

A study of the composition of typical cane soils will give us a further insight into the problem of manuring. Taking Dr. Phipson again as our guide, we find the following analyses of (A) soil from a new estate in Jamaica and (B) soil from a fifteen-year-old plantation in Demerara:—

	A. Per cent.	B. Per cent.
Moisture	12.25	18.72
Organic matter and combined water	15.36	6.03
Silica and insoluble silicates	48.45	68.89
Alumina	13.80	2.50
Oxide of iron	6.72	2.60
Lime	0.99	0.08
Magnesia	0.29	0.25
Potash	0.00	0.10
Soda	0.70	0.09
Phosphoric acid	0.10	0.03
Sulphuric acid	0.30	0.03
Chlorine	0.51*	trace
Oxide of manganese, carbonic acid, loss in analysis	0.42	0.68
	100.00	100.00
Nitrogen (in organic matter)	0.31	0.05

* Unusually high—due to proximity of a salt spring.

What does a careful comparative study of these two sets of figures show? The comparison is an interesting one, for, on the one hand we have new soil, whilst on the other, soil that has been continuously cropped for fifteen years. Examination reveals the fact that the soil A (i.e. the new soil) is richer in humus, nitrogen, phosphoric acid, and lime. We also notice that in soil B the quantity of lime is far below the quantity of magnesia, which is a very bad sign in cane soils.

Here we have verification of some of the results we obtained in studying the composition of the cane plant—the importance of nitrogen, phosphoric acid, and lime. Besides these, we have seen that potash and silica are also important soil ingredients required by the cane plant.

These facts would seem to point to a complete manure as being advantageous to the cane crop, with the addition of occasional dressings of lime, but whilst all these substances are wanted in the soil in an available form to produce a good crop of cane, a careful study of actual experiments is needed in order to understand more fully the *rationale* of manuring, since the indiscriminate application of manures is liable to result in effects detrimental to the cane and the juice. It is true that we should not be too hasty in adopting in detail the guidings of experimenters in other countries owing to differences in local conditions, yet, at the same time, such a study serves to elucidate the broad lines upon which the manuring of the sugar-cane may be based. In the light of experience both in Natal and in other countries, we will accordingly now proceed to consider the various substances mentioned above. Silica, sulphuric acid, and magnesia, it may be remarked, are rarely, if ever, added in the form of manures, as practically all soils hold sufficiently large supplies Moreover, in regard to silica, although the sugar-cane plant takes up considerable quantities of this substance, as the analyses which I have quoted go to show, whether its presence in the soil is actually necessary seems doubtful. Warington* observes that, although silica is the most abundant ash constituent of wheat, barley, oats, and other graminaceous plants, it has been shown that these may be successfully grown without this substance.

LIME.

It is stated as an axiom in cane culture that when, after prolonged cultivation, the quantity of lime present in a soil amounts to but 0.1 per cent. and then constitutes no more than one-third the quantity of magnesia, it is tolerably certain that there will be a steady falling off of the crop year by year, and that the most careful manuring will be needed to restore the soil to its proper state of productiveness. Necessary as is the presence of lime in the soil, however, its application needs to be made with great care. Lime tends to break down and so destroy humus, which forms the body—the backbone, one might say—of all fertile soils. Dressings of lime should, therefore, be backed up by liberal supplies of organic manures. A light initial dressing of, say, 500 lb. per acre of slaked lime is indicated by experiments at the Winkel Spruit Experiment Station on the south coast of Natal as a profitable operation, and such application might be repeated with advantage at each planting. "Heavy

* "Chemistry of the Farm."

and repeated dressings, on the other hand, are likely to result in an exhaustion of the other fertilizing ingredients, for lime is a stimulant and corrective rather than a fertilizer." (Sawer.) It was further noted that lime apparently exerted a favourable influence by limiting the contents of solids not sugar, with a consequent enhancement of purity of the cane juice.

NITROGEN.

Of organic manures for application as a corrective for the lime, as suggested above, the most suitable as well as the most universally used in cane growing is green manure, which will add nitrogen to the soil as well if a leguminous crop be chosen, such as the earth-nut, the soy-bean, or the cow-pea, all of which succeed in the coastal belt of Natal. The advantage of this combination of lime and green manuring will be apparent from the following considerations. In the first place, as we have just seen, an organic manure is advisable in conjunction with a dressing of lime on account of the tendency of the latter to destroy humus. Secondly, the turning under of a heavy crop of green stuff is liable to result in a souring of the soil, and this undesirable effect is neutralized by a dressing of lime. Thirdly, owing to the heavy rains which are experienced along the coast and the consequent washing out of nitrates, artificials are not always to be recommended for the application of nitrogen. Stubbs states that the ploughing in of a green crop results in an average increase over plant and first ratoon cane of 7.42 tons to the acre over the increase obtained when the green crop, instead of being ploughed in, is removed, as it is by some planters, for fodder.

It would seem, therefore, that in the conditions obtaining in the tropical and semi-tropical parts of South Africa, when a cane soil needs a supply of nitrogen over and above the supply added in the form of trash, the advantages of green manuring with a leguminous crop should be well considered, particularly as the ploughing in of legumes results in the double benefit of the addition of nitrogen and the increasing of the store of humus; it also enriches the soil by bringing up from the sub-soil stores of phosphoric acid, potash, and other substances.

The availability of nitrogen in green crops varies with different conditions, but, generally speaking, the nitrogen becomes available more quickly than in the solid portion of animal manure. Treatment (previous to ploughing under) with mixed farm manure or with liquid manure will hasten decomposition, as these substances contain the micro-organisms that bring about decomposition (Van Slyke). Harrison, however, found that the application of green and farmyard manure at the period of the cane's most active growth was inadvisable.

There are circumstances, however, in which the application of nitrogen in the form of a green manure may not prove as economical or as productive of good results as in the form of a commercial fertilizer. There is, however, this important fact to be remembered, namely, that it is a matter of common observation that canes that have received a good dressing of ammonia as young plants suffer less during periods of drought than others. In fact, in the case of young plants nitrogen is used more as a stimulant than as a direct manure.

Before proceeding to discuss commercial fertilizers I should like to draw attention to the remarkable results which have been obtained

in India from the application of castor cake as a manure for cane. The Government *Agricultural Journal of India* recently published an extraordinary photograph of a cane cut from a field manured with this material, together with the following note by Mr. R. W. Wood:—

"The photograph shown herewith depicts a striped Mauritius cane taken from a field at Katravulapalle, some eight miles from Samalkota. The size of the cane may be judged from the white spots on the bamboo to which it is tied: it was in all 29 feet long; about 23 feet of this was solid cane, the remaining 6 feet being 'top.' Though this is, of course, an exceptionally good specimen, yet the field from which it was taken was a wonderful sight, and must have averaged over 20 feet in height. The soil was a perfect alluvial loam with enough sand in it to keep it open and exceptionally deep. Castor cake, which is the accepted manure for this crop in this district, had been applied when the canes were about 3½ months old at the rate of 1660 lb. per acre."

This castor cake is, of course, the residue of the castor oil bean after the oil has been expressed. Commenting on the matter in its issue of October, 1912, *Tropical Life* says:—

"Of course this residue contains nitrogen—about 4½ to 5 per cent.—and we believe it is admitted that this nitrogen possesses a special value in comparison with that derived from other sources, since on being set free by the decomposition of the residue in the soil, the nitrogen becomes incorporated with the soil, and is therefore not liable to be washed out by excessive rains. Castor bean residue also contains a small percentage of phosphates and potash, which, as they become available for plant food whilst the residue decomposes in the soil, naturally add to its manurial properties.

"We are, however, inclined to think that its great success as a manure is due chiefly to the fact that, being vegetable, it forms humus when decayed. This, to our mind, is *the* secret, as nothing improves and maintains the fertilization of a soil so much as the presence of a plentiful supply of humus, acting upon it, as it does, in so many ways."

Proceeding now to consider the use of commercial nitrogenous fertilizers, we find that Scard, in British Guiana, has observed that sulphate of ammonia at the rate of 2 cwt. per acre gives the best results. Sulphate of ammonia has proved most satisfactory, too, in experiments carried out in Barbados; the most favourable application was from 200 to 300 lb. per acre. Harrison, in British Guiana, found that when not more than 40 lb. of nitrogen per acre were to be added (equivalent to 200 lb. of the sulphate form) there was no difference in the effects of sulphate of ammonia and nitrate of soda; the superiority of the sulphate manifested itself only when more than 40 lb. was applied. Elsewhere,* in referring to the superiority of sulphate of ammonia, he remarks:—"The alkalinity of the soil may explain why sulphate of ammonia gives better results than nitrate of soda when applied in large amounts." More than 3 cwt. of the sulphate per acre should not, according to the conclusions of Harrison and Bovell, be applied, as, although the addition of readily available nitrogen to mineral manures produces a large increase in the weights of cane grown, excessive dressing may cause a marked decrease in the richness

* West Indian Bulletin, 1909.

and purity of the juice. In other words, whatever the form of the manure, not more than about 65 lb. of nitrogen per acre should be applied to the sugar-cane.

In studying these results, however, it is necessary to bear in mind that sulphate of ammonia needs an abundance of moisture in the form of a copious rainfall or irrigation. Where the application of artificial nitrogenous fertilizers is necessary, in the relatively dry conditions experienced in South African cane-growing areas, nitrate of soda would probably be found to be the best. It may be added, however, that the addition of nitrogenous fertilizers to the cane plant is not advisable without irrigation or a plentiful rainfall.

Judging by the results of experiments carried out over a series of years by Mr. E. R. Sawer at the Winkel Spruit Experiment Station, Natal, in ordinary seasons and with good cultivation, the application of nitrogenous salts cannot be justified either from the standpoint of field returns or from the figures of profit and loss.

So far, of course, as Natal is concerned, the results of the Winkel Spruit experiments will probably apply more or less throughout. But, for the benefit of intending planters in the Transvaal, and in view of the possibility of different requirements in the case of the Zululand soils, I have been to some pains to ascertain the opinions of investigators in various sugar-growing countries in regard to the application not only of nitrogen but of phosphoric acid and potash as well, to which sections of our studies these remarks also apply.

In conclusion, it may be observed that Harrison and Bovell find that the profitable employment of purely nitrogenous manures depends largely upon the state of the soil. "If the soil is in good heart such applications may realize heavy returns; if poor, such manurings will result in heavy loss."

PHOSPHORIC ACID.

In Louisiana superphosphate is considered the best form in which to add phosphoric acid, according to Wilcox and Smith, who recommend its application at the rate of about 800 lb., analysing 12½ per cent. available phosphoric acid, to the acre.

At the Botanical Gardens, British Guiana, Professor Harrison found that the application of superphosphate of lime to plant canes gave increased yield when added to manurings of nitrogen and potash. But little, if any, advantage was gained by the use of phosphates with ratoon crops; and he is of opinion that manurings with superphosphate of lime, or with other manures containing phosphates, should be restricted to plant canes, the ratoons being manured with nitrogen only. Failing superphosphate of lime, Harrison found that basic slag was the best phosphatic manure to use. South African conditions, however, more closely resemble those of Louisiana; and confirmation of the value of superphosphates has been obtained at Winkel Spruit. Here the manuring of cane fields without the addition of phosphoric acid has been shown to be of no practical value—"the plots receiving nitrogen and potash without phosphates in no case show a higher average gain than 1½ tons in excess of the yields from the unmanured plots." It was further found that superphosphate is the most suitable and profitable form of phosphatic manure, but that its repeated application without potash is to be avoided. In these experiments concentrated superphosphate was used, the medium dressing of which was 120 lb.

to the acre. On some of the estates in Natal, however, basic slag has been found to be the best form in which to apply phosphoric acid; while the authorities at the Tongaat Estates consider the best phosphatic manure to be a mixture of bonedust and superphosphate, in equal proportions, applied at the rate of 400 lb. per acre. It is also given where necessary to first and second ratoons. A furrow is ploughed on each side of the line of plants, and the manure placed therein. Basic slag is also recommended, and this has the advantage of containing lime which cane soils call for. But on no account should basic slag be mixed with superphosphate.

The use of mineral phosphates has also formed the subject of experiment. Turning to British Guiana again we find that the use of insoluble phosphates, such as precipitated and mineral phosphates, is not advisable during the period of the cane's most active growth, but they may produce excellent results when applied at an early period in a very fine state of subdivision in large quantities and uniformly mixed with the soil. Scard found that ground mineral phosphates appeared to give an increased yield compared with superphosphates.

POTASH.

In Barbados the use of potash has been found to be attended by a profitable increase of yield; 60 lb. of potash (contained in 120 lb. of sulphate of potash) applied in January—or partly in January and partly in June—gives the best results there. For sandy loams in Louisiana, Wilcox and Smith state that about 100 lb. of muriate of potash will usually prove sufficient. Harrison and Bovell, in Barbados, found that the presence of an excess of potash in the manures did not injuriously affect the purity of the juice either by increasing the glucose or by appreciably adding to the amount of potash salts contained in it. They observed also, that the most advantageous time for the application of manures containing potash appeared to be at the stages of the plant's growth; and pecuniarily the use at this period of so-called early cane or potassic manures was far preferable to that of even the highest quality of manures which were formerly used. Professor Harrison has also observed that on some soils the application of potash salts in quantities from 60 lb. to 150 lb. sulphate of potash per acre resulted in greatly increasing the effectiveness of nitrogenous manuring. This conclusion, however, does not appear to hold good in Natal so far as the Winkel Spruit conditions obtain, for at this station it was found that the plots receiving nitrogen and potash without superphosphate yielded little more cane than the adjacent unmanured plots. The application of 100 lb. of chloride of potash resulted in a general average gain over all plots to which it was applied of 3½ tons per acre. This favourable effect, however, was only observable when the potash was given with superphosphate; and the experiments on the whole indicated a combination of superphosphate and potash as the most satisfactory system of manuring for cane grown on the soils under observation at Winkel Spruit. (The medium dressing used of chloride of potash was 100 lb. per acre.) With regard to the financial aspect, Mr. Sawer says:—"The highest profit by far was obtained from the superphosphate-potash mixture, viz., £7. 2s. per acre, and as the average yield from the plot receiving this dressing in series 'A' was within 34 lb. of the maximum, and in the case of series 'B' only 1 ton 21 lb. short of the maximum, and

whereas such maxima were obtained in the one case from the expensive complete dressing with the addition of lime, costing £4. 5s. per acre, the case for the general employment of the superphosphate-potash mixture, costing only £1. 4s. per acre, is complete."

COMBINED MANURES.

The effects of combined manures upon the cane crop have been studied at the Hawaiian Sugar Planters' Association Experiment Station, where it has been observed that, owing to the fact that a definite relationship exists between the efficiency of a fertilizer mixture and the quantities and proportions in which its ingredients are associated, due to biological, chemical, and physical effects which its component parts have in a given soil, variations in the composition of the mixture beyond certain limits may materially influence crop yields. The greatest loss from the use of improper mixtures is apt to occur on acid soils, and in such cases considerable risk is involved from the continued application of mixtures containing sulphate of ammonia, sulphate of potash, and superphosphate when lime dressings are not previously made. The application of nitrogen in mixed fertilizers, it has also been found, entails some risk of reduced efficiency if either the potash or phosphoric acid (in the form of soluble salts) is made to exceed the weight of this element. Therefore, unless through past local experience or carefully conducted field tests it has been definitely determined that a modified formula may be expected to give increased yields, it is safer, when applying nitrogen, potash, and phosphoric acid in the form of soluble salts, to have the mixed fertilizer contain even quantities of these elements, which should not exceed 60 lb. per acre in the case of each element.

As a result of experiments at Winkel Spruit, Mr. Sawer is of the opinion that a preliminary dressing of lime to the amount of, say, 500 lb. per acre, followed by the regular application of superphosphate and potash chloride, can be confidently recommended as the most profitable system of manuring applicable to Uba cane planted in similar soils to those employed for the experiments and in the conditions obtaining on the Natal coast.

APPLICATION OF MANURES.

According to the practice in other countries, it has been found preferable not to give the whole of the fertilizer in one application, but to reserve a portion for application at a later stage of the plants' growth. Harrison and Bovell recommend two, or even three, dressings. They also suggest that the young cane plants be suitably manured, and then, later on, phosphates and potash added—the latter only if not applied with earlier manurings. The advisability of applying fertilizers in two dressings has also been confirmed by experiments conducted by Dr. H. W. Wiley, Chief of the Bureau of Chemistry of the United States Department of Agriculture. Sawer recommends reserving one-half of the total dressing of phosphates and potash for the second dressing.

In making the second application of fertilizer, a furrow about 8 or 9 inches deep is ploughed down each side of the cane row, about 12 inches away from the stools. The fertilizers should then be carefully mixed and immediately placed in the bottom of the furrow. A small plough set to a depth of about 5 or 6 inches is now run along to cover the fertilizer with a layer of soil.

EFFECT OF MANURES ON CANE AND JUICE.

No evidence appears to be forthcoming that the mineral constituents of sugar-cane manures exercise any appreciable influence upon the saccharine richness of the canes, with the possible exception of potash, the use of which seems in some cases to have been accompanied by richer juice in the canes.

The study of the effects of manuring upon the composition of canes, undertaken by Mr. Sawer in Natal, has yielded some interesting results. The satisfactory effects of alkaline manures, potash, and lime on the composition of the juice are noted. The plots receiving superphosphate and lime returned in both series a juice of very high purity, low contents of solids-not-sugar, and a low glucose ratio. "Second in the general order of merit comes the plot receiving lime and a dressing of complete manure. Similarly, if the plots receiving potash be compared with those which received incomplete manures without this ingredient, it will be noted that the potash effected an apparent reduction in the amount of solids-not-sugar present in the juice and thereby increased the standard of purity. An initial dressing of lime, followed by the regular applications of the superphosphate-potash mixture, is therefore to be advocated for the purpose of securing the best returns both in field and factory. It is true that manuring cannot be shown to have the effect of increasing the percentage of sucrose present in the normal juice, but if approved fertilizers be applied, there is little doubt that a more workable juice may be obtained, permitting a more complete and more profitable separation of the crystallizable sugar." (Sawer.)

In concluding his observations upon experiments carried out by him at the Botanic Gardens, British Guiana, Professor Harrison remarks: "The results confirm those of previous experiments that neither the addition of phosphoric acid, of potash, nor of lime to the manures favourably affects the sugar contents of the juice of the cane. The effect of nitrogenous manurings appears to be to somewhat retard the maturation of the canes, and thus the juice of the canes is not so rich in saccharose as is that of canes grown without manure. But this effect is far more than offset by the larger yields of produce resulting from the application of nitrogenous manures and the fact that the increases produced by the nitrogen are principally due to the development of the stalks in length and in bulk and not to abnormal increases in the amounts of tops and leaves or the production of new shoots to the stool."

Scard, also in British Guiana, has found that neither manures nor lime produce any perceptible difference in the purity of the juice but only affects the weight of cane.

THE FUNCTION OF CANE MANURES.

So much from the study of actual analyses and experiments. An insight into the *rationale* of these considerations must be of material assistance to the planter, and a little study in this direction will next claim our attention. The matter may be conveniently presented as follows:—

(1) We have seen that sugar is composed of *carbon* and *water* (which latter, in turn, is made up of *hydrogen and oxygen*).* Any

* The proportions are $C_{12}H_{22}O_{11}$.

effects which manures may exercise upon the juice must, therefore, be indirect.

(2) Being a *carbohydrate*, sugar is elaborated in the leaves of the plant, thereafter to be stored up in the cells of the stalk.

(3) Obviously, therefore, the *healthier* the plant the more fitted will it be to elaborate cane-sugar; the greater the *leaf area* the more sugar will it be able to produce; and the longer and thicker the *canes* the greater storage capacity will it possess for the sugar thus elaborated.

(4) To produce this healthy plant, the chief plant-food substances which call for the sugar-planter's attention are *nitrogen*, *phosphoric acid*, *potash*, and *lime*.

(5) *Nitrogen* stimulates growth of leaf and stalk, thus fulfilling to a great extent the requirements of the planter [see above (3)]. This substance should, therefore, be present in sufficient quantities in every cane soil.

(6) The presence of sufficient quantities of *lime* in the soil is the next consideration for the planter. Lime liberates the phosphoric acid and potash already in the soil, thereby obviating the necessity for heavy dressings of manures containing these substances. It also neutralizes the acidity which is liable to follow heavy green manuring.

(7) *Phosphoric Acid and Potash*.—Whilst the soil must be watched, by periodical analyses, for any signs of diminishing supplies of these two substances, it is probable that in the case of the latter the application of lime will meet the requirements of most soils for some time to come.

(8) Finally, Warington* states that the formation of carbohydrates in the plant is dependent on the presence of nitrogenous matter, phosphates, potash, and the other essential ingredients of plant food; "a plant poorly provided with these substances produces only a small quantity of carbohydrates."

ESTATE MANURES.

I use this term to describe the various forms of manure produced or producible on the sugar estate. We have already studied the value of green manuring as a means of adding nitrogen to the soil and enriching it in humus. In this connection Professor Earle advises Cuban planters to sow cow-peas broadcast between the rows of sugar-cane in April or early in May, covering them afterwards by means of the horse-cultivator.

The trash, or dead leaves, after the cane has been cut and removed from the field, is raked to the middle of the space between the rows. On some estates it is allowed to rot, when it is either buried for the fertilization of the next crop, or raked back when the ratoons are above ground. On other estates the trash between the first and second rows is raked over into the space between the second and third row, and so on, thus leaving every alternate space free for cultivation. It is not ploughed in until the land is turned over for replanting, by which time it has mostly decomposed. The trash, of course, keeps down the weeds and also serves as an excellent mulch against the evaporation of soil moisture. At Tongaat and elsewhere

* "Chemistry of the Farm."

the clear rows are ploughed and the trash drawn over again and the alternate rows ploughed. In other cases the trash is burned just as it lies on the ground, the practice being advocated as a means of destroying insect life, whilst the burning of the trash seems to result in much better ratoon crops than is observable in cases where it is buried only. On the other hand, it must be remembered that the burning of trash involves the liberation of nitrogen and the destruction of potential humus that would improve the moisture-retaining capacity of the soil, apart from the returning of a portion of the nitrogen and salts removed by the previous crop.

Wray emphasizes the value of the cane itself as a manure after the expression of the juice. He observes that it has been estimated by numerous planters and others that not more than 50 per cent. of the weight of the cane is obtained from it as juice by the ordinary mills used for crushing on estates in the West Indies, whereas it has been demonstrated that the plant consists of 90 parts fluid and 10 parts woody fibre. He then proceeds to estimate the value of the bagasse as manure, and arrives at the conclusion that it is more profitable to purchase coal than to burn the bagasse. Whether our Natal planters will agree with this conclusion is doubtful. In any case, the use of bagasse as fuel is the general practice in the coast mills, a number of which are now fitted up with patent furnaces for the consumption of green bagasse. The ash, then, is the only available fertilizer so far as the bagasse is concerned; the act of burning, however, reduces the salts to a less soluble condition in some soils; nevertheless the returning of the ash to the soil involves the replacement of the mineral constituents which have been removed by the crop. The soil, therefore, in the long run, if this practice is followed consistently season after season, will not become appreciably impoverished. If this is combined with green manuring, the fertilization of the soil will be fairly complete, even though not as satisfactory as in cases where it is practicable to apply the unburned bagasse.

To these manures may be added the sediment in the fermentation vats consisting of dead yeast cells. This "sludge" is used as a fertilizer on some of the Natal estates as elsewhere in sugar-producing countries, being in some cases, after liquid manure has been added, pumped on to the land. It has proved to be quite a valuable concentrated nitrogenous fertilizer. Elsewhere it is applied in its natural condition or put through the filter presses and converted into cake.

The establishment of compost pits for the collection of these substances, bagasse-ash and manure from the animals on the estate, with other organic matter, may be found profitable on some plantations. Such a compost must prove of considerable value. The Natal Estates use a compost consisting of filter press cake, bagasse-ash, and molasses. The Tongaat Estates apply a compost of filter press cake and bagasse-ash at the rate of from nine to ten tons to the acre; whilst on the Central Sugar Company's Estates at Verulam for the fields around the mill—that is to say, within a radius of about two miles (beyond which it does not pay to transport the manure)—a compost consisting of dunder, treacle, bagasse, ashes, lime, etc., is applied. Large quantities of this manure are used; the rate of

application is 500 lb. to the acre. This is applied to the plant canes; if further manuring is later found to be necessary, artificial fertilizers are used.

To all intents and purposes all that is removed from the sugar estate in the form of either sugar or alcohol is practically carbon, oxygen, and hydrogen, none of which has any manurial value. It consequently follows that if all the offal—that is to say the trash, the bagasse, and the factory waste—can be returned to the land, no impoverishment of the soil can result. Not in all cases, however, can this be carried into full effect, since many modern factories use the bagasse as fuel for the furnaces, in which case the nitrogen is lost, the salts only remaining in the ash. But this loss of nitrogen can be made up by the growing and ploughing under of a crop of cow-peas or other leguminous plant as has already been observed, or by dressings of sulphate of ammonia. Furthermore, the sugars contain varying proportions of ash (the lower the grade the greater the percentage of ash)—roughly speaking about 10 per cent. of the ash constituents contained in the canes, according to Deerr.

There now remains to be considered pen or kraal manure. In Mauritius considerable attention is given to this as a source of manure. Deerr describes the method adopted as follows:—

"The live stock of the estate, which may number from two or three hundred, are in great part kept in *parcs*, which may be from fifty to a hundred yards square; a portion of the *parc* is often covered in to provide shelter in inclement weather. The whole area of the *parc* is covered with cane trash transported from the fields and used as bedding. During the whole year, if the supply of labour is sufficient, the soiled litter is in continual process of renewal and removal, the bedding being removed on an average of once a week; on removal it is placed on stone platforms or in basins ten feet deep, both platforms and basins generally being about fifty feet square. The whole mass when completed is continually watered with fermented molasses and water or distillery refuse and sometimes with dilute sulphuric acid; the drainings collect in stone pits and are continually repumped over the heap of manure; the object of this is to rot the manure and at the same time fix any volatile ammonia given off. In from six to twelve months the manure is considered sufficiently rotten to place on the fields, where it is applied at the rate of from ten to twenty tons per acre to plant canes only, generally at the age of three months, or occasionally the cane holes are filled with manure and the tops planted on it."

MANURING OF RATOONS.

We have seen that Professor Harrison is of the opinion that the application of manures containing phosphates should be restricted to the plant canes, the ratoons being manured with nitrogen only. The Cuban Experiment Station recommends, after the cane has been cut, the drawing of the trash into every second row and the ploughing of the alternate cleared spaces, the soil being turned away from the cane rows. The last furrow runs close up to the cane, so that artificial manures can be applied around the roots if necessary. The soil is then thrown back by a cultivator and is kept well tilled by regular cultivation until the beginning of the rainy season, when the ratoons

have grown to a good height. At this time the cultivated middle spaces are sown with cow-peas.*

IRRIGATION.

We have seen, in considering climatic requirements, that, other conditions being favourable, the sugar-cane requires for its best development an annual rainfall of about 100 inches. In regions therefore whose rainfall falls considerably short of this quantum—as in Natal—irrigation may be advantageously pursued, given a plentiful supply of water and suitable fields. In Natal, irrigation is hardly practised at all, principally on account of the hilly nature of the country in most districts in the sugar belts, but there are areas—for example, the river flats of the Empangeni, Umfolosi, Umkuzi, and Pongola—where the natural rainfall might be supplemented by artificial means, and it is possible that the feasibility of an annual, instead of a biennial, crop of cane might then be demonstrated. The practice of irrigation would furthermore open up wider possibilities in the matter of choice of varieties of cane. The universal adoption of the Uba variety in Natal is due largely to its drought-resistant properties, but it is admitted by experienced planters that, were they able to irrigate their sugar lands, the introduction of better varieties would be more likely to meet with permanent success.

Irrigation is practised widely in Hawaii, Cuba, India, Egypt, Java, Mauritius, Peru, and elsewhere; in some of these countries, in fact, sugar-cane culture would not be a practical proposition without this supplement to an insufficient rainfall. In Hawaii the cane crop is now independent of the rainfall, and after enormous capital expenditure unequalled results have been obtained.

The following description of Hawaiian practice is given by Noel Deerr:—

"During a period of growth of about seventeen months, the total water supplied to the crop averages about 100 inches. Reference to the table below will show that the young cane received less water than when more mature, but not so much less as might be thought proportionate, considering the different states of young and of mature cane. The causes at work are twofold: when the cane is young the whole ground is exposed to the direct rays of the sun and to the action of winds; when the cane is older the foliage shades the ground and lessens loss due to evaporation, and to a large extent conserves water in the soil. At twelve months of age the crop actually consumes in its economy ten times as much water as a crop one month old, but owing to the causes mentioned above the apparent consumption is much less disproportionate.

"It was found by experiment in Hawaii that the best results were obtained when the young cane received 0.5 inch per week, less favourable results were obtained when the water supplied was 1 inch per week, and when the furrows were filled with water the cane came up yellow and sickly. As the cane comes away it requires about 1 inch weekly up to three or four months, after which 1.5 inches are necessary until the crop is in full vigour, when 3 inches and never more are required. These figures refer to natural and artificial supplies combined."

* *Agricultural News*, 14th November, 1908.

It is also stated that 1000 lb. of water are required per pound of sugar produced. The following is the table referred to above:—

Table giving Water used in Production of a Cane Crop.

Period of Application.	Monthly Rainfall. Inches.	Irrigation Water Monthly. Inches.
July...	0.94	4.0
August	1.58	4.0
September	0.88	4.0
October	1.75	3.0
November	1.32	3.0
December	1.80	2.0
January...	1.00	4.0
February	3.73	6.0
March	3.98	3.0
April	0.85	4.0
May	2.01	4.0
June...	0.88	7.0
July	0.17	7.0
August	1.90	9.0
September	0.75	8.0
October...	2.92	6.0
November	0.47	3.0
	26.99	76.0

The following figures, also quoted by Deerr, contain much information regarding irrigation in Hawaii:—

Gallons of Water used by the Crop per Acre.

Crop.	Volume of the Rainfall per Acre. Gallons.	Volume of Irrigation per Acre. Gallons.	Total Water Received per Acre. Gallons.
1897-8	1,260,150	1,273,700	2,533,850
1898-9	728,990	2,059,600	2,788,590

(These figures refer to a seventeen months' crop.)

Total Consumption of Water per lb. Sugar Produced.

Crop.	Weight of Water used per Acre. lb.	Weight of Sugar produced per Acre. lb.	Water used per lb. of Sugar. lb.
1897-8	25,338,500	24,775	1,023
1898-9	27,885,900	29,059	959

The cost of irrigation in Hawaii is enormous; Stubbs quotes it as being $73.75 per acre, of which $35.62 were for pumping and $37.13 were for labour (Deerr).

In Cuba the fields are irrigated every ten days, and the total irrigation is equivalent to an annual rainfall of 150 inches.

The system followed in Mauritius is to run a main canal along the top end of the field and from this lead the water by smaller ditches down the field. These secondary ditches are dammed temporarily at each cane row in turn, so as to turn the water along the row.

(To be continued.)

The Maize Stalk Borer and its Control.

(*Sesamia fusca*, Hamp.)

By WILLIAM MOORE, B.A., Lecturer in Entomology, School of Agriculture, Potchefstroom.

INTRODUCTION.

No doubt the most serious pest of maize in South Africa, and particularly on the high veld, is the maize stalk borer. This insect is the well-known grub which bores in the stalk of the maize plant, killing the growing shoot of the young plant, but it should not be confused with the cutworm and the maize cob borer. The cutworm does not bore in the stem of the plant but cuts off the young plant shortly after it has appeared above the surface of the ground, just at the surface or just beneath the surface of the soil. The cob borer is frequently found on the cob of the maize eating away the tender grain. This insect is more apt to be confused with the stalk borer, as both species may be found upon the cob. The larva or grub of the stalk borer is generally nearly white in colour, with a few black spots, the eyes and "collar" being brown. The cob borer is, however, a dirty white or greyish, and the eyes are grey, with light and dark bands. Another distinction which might be made is that the cob borer usually enters at the silk or outer end of the ear, while the stalk borer usually enters at the base of the ear where it is attached to the stalk. To most farmers, however, the stalk borer, as a grub, is very well known, but it might be well before discussing its control, to give briefly its life history.

LIFE HISTORY.

During the second and third weeks of November, or sometimes later, depending upon the season, the adult moth may be found flying about the maize field laying her eggs under the leaf sheaths in clusters of about fifty. These eggs hatch in from six to eight days and immediately begin to feed in the funnel of the plant. If at this time the top is pulled out of the plant and the leaves carefully unrolled, as many as twenty-five to one hundred young grubs will be found. Due to the large number of grubs on the one plant, the food supply soon becomes limited, with the result that many of the grubs migrate during the night to other stalks. These grubs enter the new plant near the base and bore their way up through the centre of the plant. The damage done by these grubs is probably the most serious of any stage, as the grubs destroy the heart of the plant, thus preventing any further growth and the possibility of the plant ever reaching maturity. On a bad year so serious is the damage done at this time that some farmers never reap as much maize as they had sown. The grubs reach their full growth about the first or second week in January and transform into the pupal or resting stage. After about a fortnight or three weeks the adult moth emerges and lays her eggs. The maize plant by this time is generally in tassel, and the young ears are forming. Due to the advanced stage of the maize the grubs of this second brood never succeed in doing nearly

so much damage as the grubs of the first brood. They bore in the stem of the plant, and although they must consume a large amount of valuable cattle food the average farmer in South Africa does not consider it much loss if he receives his return of maize grain. Sometimes the grubs of the second brood do considerable damage by boring in the ear of the maize. When full grown, which is generally about the approach of winter, the grub seeks a sheltered place in the stalk, generally at the base just beneath the surface of the soil. Here it hibernates as a grub through the winter, not pupating until late in September or early in October. The number of moths of the first brood in November depends upon the success of these hibernating grubs in passing the winter.

Methods of Controlling the Maize Stalk Borer.

There are several methods which have been advised by means of which the farmer would be able to reduce the grubs of the first generation to such an extent that he would be able to obtain a good stand of maize. There is only one method based upon poisoning the grubs, all others being based upon the destruction of the grubs during the winter, which is really the weakest point in their life history.

Poisoning.—While the grubs are still young and found in the funnel of the maize plant, i.e. before they have migrated, they can be killed by placing a pinch of vaporite in the funnel of each plant. This method is adopted by some farmers, particularly in Natal, and is claimed to give very good results. This method has several drawbacks, first the expense of doing any large area, second, in most parts of the country it could not be adopted, due to the labour necessary to do a large area quickly before the grubs would begin to migrate and reach an inaccessible position, and third, even if well done, it would hardly give as good results as some of the other methods which have been advised. The greatest drawback, however, is the labour required. One man could hardly do more than five acres a day, and do it well, so that in order to do one hundred morgen it would require at least eight men working for a week.

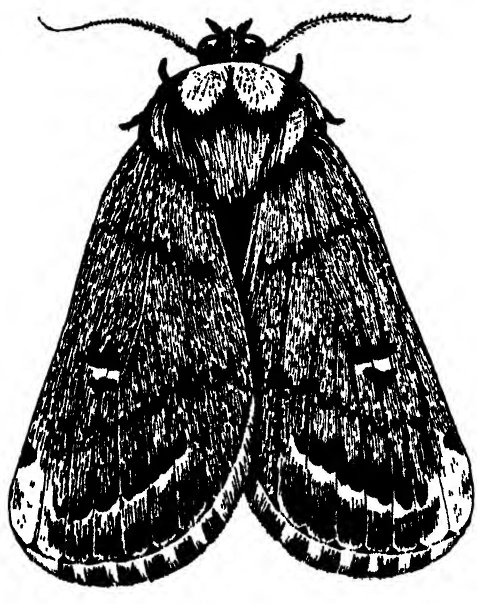
Trapping.—Trapping is accomplished by planting some very early maize so that the moths emerging will lay their eggs upon this maize. The maize is then cut by 1st December, and the grubs destroyed by feeding the maize to stock. This method of lessening the attack is often used, but if it is the only method adopted and there are many moths about, it will not prove as effective a measure as desired. By planting early maize all round a field of maize of the previous year, many of the moths might be prevented from flying to present year's maize.

Late Planting.—Late planting is a measure which should always be adopted wherever possible. By planting the maize in November it will not be up in time for the first brood of the moths, which, it will be remembered, is the most destructive, and they will either find other food plants or die. This measure in the colder parts of South Africa is not always possible, as the farmer must plant earlier in order to harvest his maize before the early frosts.

Silage.—Cutting the maize for silage is a means of doing away with the stalk borer, which might be more generally practised in South Africa, not only as a means of doing away with the borer but also as a means of saving the lives of valuable cattle in a case of drought such as the present year. In cutting the maize for silage

it is preserved in excellent condition for stock food, and being harvested in the field before the stalk borer has sought its winter quarters, the borer is removed with the fodder and is destroyed when the fodder is cut for ensilage.

The value of silage as cattle food is given by Mr. Alex. Holm as follows:—One ton of silage will feed an ox or cow for a period of three or four winter months. One morgen of maize will produce from sixteen to twenty tons of silage; should a farmer therefore have two hundred head of cattle it would require from ten to twelve morgen of maize to feed them for three or four months. The drawback to this method of ridding the farm of the stalk borer is the fact that the average farmer does not wish to cut all his maize up into silage but wishes to harvest some as grain. Such cases can be met by adopting one of the following methods for doing away with the grubs in the portion of the field not cut for silage.



1. MOTH OF THE STALK BORER.

Maize Fodder as a Preventive.—Turning the maize crop into fodder is a method advised by Mr. C. W. Mally in the *Cape Agricultural Journal* as one of the best measures to be adopted. This method of harvesting the maize is used throughout the United States and Canada, and gives fodder which is much more valuable as cattle food than the method usually adopted in this country. As the proper method for making fodder does not seem to be known in South Africa it might be well to briefly describe it. The maize is cut before it is ripe, just when the lower leaves are dry and the grain in the cobs is hardening. It is then stood up in the field in what is known as stooks. For this purpose, before cutting the maize, "props" should be prepared in the field around which the maize is placed when cut.

These are made by bending down three or four maize stalks so that they meet between the rows, and then tying them together near the top. The first row of these should be made eight yards in from the edge of the field, and the first stook should be eight yards in along the row. Each stook should be sixteen yards apart in the row, and each row should be sixteen yards apart. By this means each stook would contain the maize from an area sixteen yards square. In cutting the maize a "corn knife" is much better than a sickle, as it is possible to cut the maize much lower. A corn knife is a very long knife, with a blade about one and half feet in length and about two inches in width. It is used something after the fashion of a sabre. The maize when cut is stood up around the "props" slanting just enough to stand nicely. When a stook is finished it should be tied around with a piece of twine about one and a half to two feet from the top. In this position the fodder and grain ripen, are not injured by frost, and will not become mouldy. When ripe the ears are husked and the fodder tied in bundles and stacked for cattle food. Where possible the fodder should be shredded or cut before feeding as it makes a better food and the animal will eat more of the stalk, but as either shredding or cutting requires a special machine this is not always possible. In such a case the fodder can be used without cutting or shredding.

In cutting the maize as above most of the stalk borers are still in the stalk and will be destroyed in cutting or shredding the fodder. Where the fodder is not cut there is a chance of the borer wintering through in the stalk, especially if the stalk is protected in the stack. In that case the stalks which are left in the field by the cattle should be collected with a horse-rake, not later than October, and burned.

The greatest objection to this measure of controlling the stalk borer is the fact that it requires the farmer to entirely change his method of harvesting his maize, adopting an entirely new method. This is always a very grave objection to the farmer, for the average farmer likes to use the method of doing things which his father and grandfather used.

Burning the Stalks.—Another method used by some farmers is to harvest his maize ears and then pasture his maize field, later pulling out all the stalks not eaten and burning them. This is a very good measure if properly carried out, but generally the labour required to pull and burn the stalks is too much, and the farmer fails to burn the ends not eaten, in which case he is adopting one of the best methods for breeding the moths in large numbers.

The Effect of Cold on Maize Stalk Borers.—The effect of temperature upon the hibernating larva or grub of the maize stalk borer does not seem to have received any study. At the Potchefstroom Experimental Farm about seven years ago, the stalk borer was very bad and did a great deal of harm to the maize. During the last several years the attack of the first generation of the season, the generation which does the most damage, has been very slight, in fact only a very few plants were killed, and these were generally near the border of the field. The individuals of the second generation, however, were always numerous, but the damage done by them was not great. As it is the grubs of this second generation which hibernates and produce the first generation of the following year, one would naturally expect the grubs to be very abundant the next year unless

some factor was at work to reduce or kill off the hibernating grubs during the winter.

Only a small acreage of maize is cut for silage each year, and the rest has been allowed to ripen in the field before being cut. After ripening, but not before the grubs had an opportunity to reach their winter quarters in the base of the stalk, the maize stalks were cut, the ears harvested, and the stalks fed to the cattle. After the maize was harvested, in some cases the field was ploughed and sown with other grain such as wheat as a winter crop, in other cases the field

2. MAIZE STALK, SHOWING THE UPPER PORTION DEAD, DUE TO THE INJURY OF THE GRUB.

was ploughed but not sown, and in the spring was cross-ploughed and sown with some summer crop. The stalks were never pulled out and burned, in fact the only direct preventive measure apparent was the late sowing of the maize, generally in November.

During the last winter steps were taken to find out why each year the first generation of the moth was so small. For this purpose a large number of the stubbles were collected and examined in late June. In many of these stubbles the grubs were found to be

dead, black in colour, and dried up. At first it was thought to be a bacterial disease which had killed these grubs, but as a bacterial disease is generally spread by the grubs feeding upon infested food, and as the grubs do not feed in the winter, it did not seem likely that such could be the case. Other fields not on the Experimental Farm which did not have the stalks cut did not show these dead grubs.

Experiments were then undertaken to see if they could have been killed by cold. For this purpose a number of grubs were exposed to a temperature of 5° F., which froze them hard. None of these ever survived after being removed from the influence of the cold, and in a few days they turned black and were in appearance exactly similar to those found in the stalks. Other grubs were exposed to low temperature but not so low as the first, the object being to find out what was the critical fatal temperature, or in other words, what was the highest temperature which was cold enough to kill them. From these experiments it was found that if exposed for half an hour to a temperature of 26° F., i.e. 6 degrees of frost, or if exposed for one hour to 28° F. or 4 degrees of frost, the grubs were frozen hard, and although they partly revived on being thawed out they only lived for a day or two, when they died and turned black.

These grubs which were killed by the cold were in appearance exactly similar to those found in the field.

In order to make sure that it was not a bacterial disease, and as the bacteria could not be introduced by their food as they did not feed at that time, healthy grubs were placed in the same stalk beside some of the dead grubs, but they remained quite healthy. Some of the semi-fluid contents of the dead grubs was also smeared over healthy grubs, but they did not die. It seems, therefore, that there is no disease which is spread by contact, and as they do not feed there is no doubt that the cause of the death of the grubs was the cold, and that the bacteria to be found in them were due to decomposition, and were not pathogenic.

PARASITISM OF MAIZE STALK BORER.

Besides the grubs found to be dead from the cold, others were found to be destroyed by a Braconid parasite, **Stenopleura sesamiæ* (Cameron), and also by a species of predacious ants, *Dorylus helvolus*. The Braconid parasite is a very small insect, not quite one-eighth of an inch in length. The female lays a number of eggs inside the body of the grub, where they hatch and live until full-grown on the body juices of the grub. When full-grown the larvæ of the parasite eat their way through the body of the grub and each spins a little cocoon in which it pupates. The cocoons are often to be found around the body of the grub and may be thought by some to be eggs of the grub, but such could not be the case as the grub is not sexually mature and could not lay eggs, only the adult, which is a moth, being able to lay eggs. After spending some time as a pupa inside the cocoon the little parasite finally emerges, one end of the cocoon being opened like a cup for the purpose. It is then a tiny four-winged insect, each female of which, after fertilization, being able to destroy another stalk borer grub by laying a number of eggs in it. The stalk borer dies after the larvæ of the parasite emerges from its body.

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* Determined by H. L. Viereck, of the United States Bureau of Entomology.

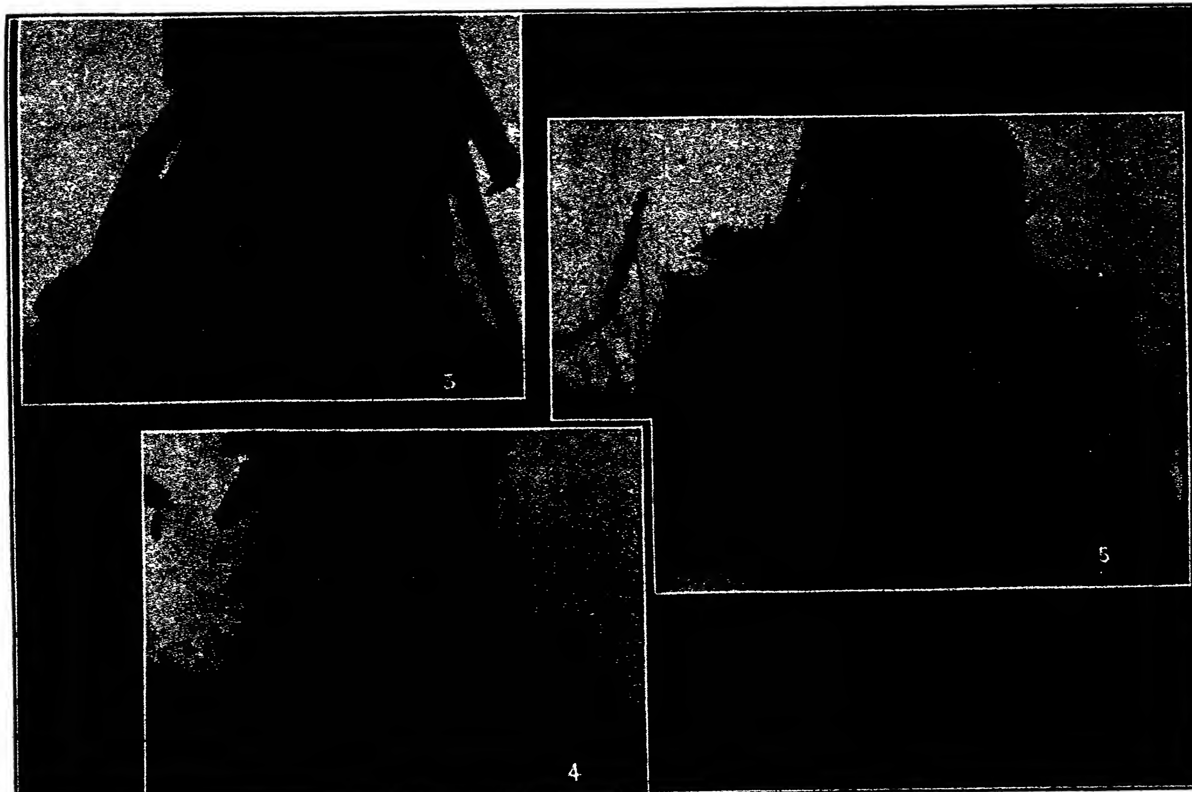


Plate No. XXXVII

3. The Grub of the Stalk Borer in Winter Quarters. 4. Grub killed by Braconid parasite. (Notice cocoons of parasite at the base of the stalk.) 5. Grub killed by cold. (Notice dark colour.)

Less is known as to what happens when the stalk borer is attacked by the ants. Little is known concerning the group of ants to which this species belongs. They are divided into four groups: the males, the females, major workers, and minor workers. The females are large and greatly resemble a queen termite or white ant. They are very rarely found, in fact they are considered one of the rarest insects. The male, however, is very well known, being the large brown insect which comes into the house during the spring about the time of the first rains, being attracted by the light. Reference to the figure will probably recall the insect to the mind of the reader, and probably some will be able to remember the pinch they can give with their sharp mandibles. Both the major and the minor workers are quite blind, and spend their lives in the ground, where they feed upon various grubs, etc. In many cases where the grubs of the stalk borer had been attacked by these workers the body of the grub was covered with the heads of the ants, the bodies having been detached while the head remained clinging by the tightly closed mandibles.

Exactly what had happened is hard to say, but it looked very much as though the grub when attacked by the ants had retaliated by biting the ant in two.

ACTUAL VALUE OF COLD AND PARASITES IN CONTROLLING THE STALK BORER.

Actual counts were made to determine the exact value of the cold and the parasites in reducing the number of stalk borers. In a field when ploughed most of the stubbles are turned out and lie on the surface. Several hundred of these stubbles were collected and examined, with the following results:—

Field No. 1. Maize cut for silage, ploughed 3rd to 8th June, sown with wheat and irrigated. Stubbles collected and examined 8th August.

Grubs alive	4 to 40 %	...40 % alive.
Grubs frozen	3 to 30 %	60 % dead.
Grubs destroyed by Braconid ...	2 to 20 %	
Grubs destroyed by *D. helvolus* ...	1 to 10 %	

Field No. 2. Maize not cut for silage. Ploughed about 20th June, but not planted with any other crop. Stubbles collected and examined 8th August.

Grubs alive	36 to 52·9+ %	...52·9+ % alive.
Grubs frozen	24 to 35·2+ %	46·9+ % dead.
Grubs killed by Braconid... ...	6 to 8·8+ %	
Grubs killed by *D. helvolus* ...	2 to 2·9+ %	

Field No. 2. The same field as given above but the stubbles were collected on 8th October.

Grubs alive	2 to 3·4+ %	... 3·4+ % alive.
Grubs frozen	41 to 70·6+ %	96·4+ % dead.
Grubs killed by Braconid... ...	10 to 17·2+ %	
Grubs killed by *D. helvolus* ...	5 to 8·6+ %	

Field No. 3. Maize not cut for silage. Ploughed 13th to 17th July, but not sown with another crop. Stubbles collected and examined 11th October.

Grubs alive	2 to 11·1+ %	...11·1+ % alive.
Grubs frozen	10 to 55·5+ %	88·8+ % dead.
Grubs parasitized by Braconid ...	4 to 22·2+ %	
Grubs destroyed by *D. helvolus* ...	2 to 11·1+ %	

These actual counts show the value of exposing the stalks to the cold and parasites. It is interesting to note the small number of grubs found in the field No. 1, which had been cut for silage, as compared with No. 2, which had not been cut for silage. The small number found in No. 3 was rather due to the fact that not as many stubbles were examined. The increase in the percentage destroyed by the Braconid and also the ant *D. helvolus* between 8th August and 8th October should be noted. The parasite would breed slowly during the winter, but with the warmer weather breeds more rapidly.

The results given above were from stubbles lying on the surface, i.e. those ploughed out in the ploughing of the field. In order to find out what happens to those ploughed under, a large sackful of stubbles were buried to the same depth as they might be buried in ploughing them under. Wheat was then planted over this area, and a large wire cage placed over the plot in order to capture any moths which might emerge and make their way out. Towards the end of November the wheat was mature and cut and the cage again placed back over the buried stubbles. Not a single moth emerged by 30th December, although if they were to emerge they should have at least been out by 30th November. The plot was dug up 2nd January and the stalks were all rotted. A few of what might have been the empty pupal cases were found, but no other evidence of the stalk borer.

SOIL TEMPERATURE.

From the above it is seen that the maize stalk borer, at least over the high veld and probably many other portions of South Africa, is living, so to say, by the grace of the farmer. It seems to receive just sufficient protection from the cold due to its being at the base of the stalk about three inches below the surface of the soil. It is further protected from its Braconid parasite by the farmer not cutting the maize low. Unfortunately as there are no records of the temperature of the soil at a depth of three inches it is not possible to say exactly what parts of South Africa are cold enough to freeze out the hibernating grubs. A few records taken may be of some value in showing how the grub is protected from the cold.

Temperature,	exposed at surface of the soil	41°, 31°, 34°.
"	three inches beneath the surface in dry soil...	52°, 42°, 42°.
"	" " " wet soil...	48°, 40°, 39°.
"	inserted in maize stubble *standing* in wet soil	48°, 42°, 41°.
"	*lying* on the surface of wet soil	38°, 30°, 38°.

These readings show that the difference between the temperature at the surface of the soil and three inches beneath the surface would in many cases be just sufficient to save the life of the grub on a cold night. They also show that such protection is entirely done away with if the stubble is removed and is lying on the surface, such as would be the case if the stubble was ploughed out.

The difference between the temperature at the surface and three inches below the surface is also influenced by the colour, the nature, and the moisture of the soil. A few readings will show this difference.

	At the Surface.	Three inches below.
Loose dry black soil	37°	53°
" "	37°	53°

	At the Surface.	Three inches below.
Loose dry brown soil	36°	50°
" "	38°	49°
Loose moist brown soil ...	39°	45°
Compact wet black soil ...	39°	47°
Compact dry brown soil ...	36°	49°

WINTER PLOUGHING AS A CONTROL MEASURE.

From the experience at the Potchefstroom Experimental Farm it is apparent that winter ploughing is a means of controlling the maize stalk borer. The exact portions of South Africa where such measures would be sufficient are not known. The average difference during the winter months, June, July, and August, between the ordinary temperature records and the temperature at the surface of the ground is about 4.5° F. Roughly speaking, wherever frost is obtained, i.e. wherever a temperature of 30° to 32° is obtained in the screen, there is a possibility of the grubs being frozen out if the stubbles have been ploughed up. It may not always be successful, as the colour of the soil, the exposure, the amount of moisture, etc., all have some bearing upon the success of the treatment. The stalks should be cut low and as early as is necessary in order to plough the land by 1st or the middle of July. If the land can be ploughed and sown with wheat under irrigation, so much the better, as the irrigation will make the temperature at the surface lower. Winter ploughing is of value not only for the stalk borer but also for the cutworm and the cob borer, these latter being exposed to the attacks of birds and parasites.

Rainfall and Evaporation in relation to the Conservation of Soil-moisture.

THE main object of the following remarks is to adduce reasons for the adoption in this country of all such methods of treating the land as will not only enable the maximum possible amount of moisture to be stored but also tend to its retention in the soil until it is required for the growth of crops.

Rainfall.—For agricultural purposes a bare statement of the average amount of rain falling throughout the year, although useful to a limited extent, may at times prove not only misleading but actually detrimental. It is considerably more important to ascertain its distribution throughout the year, seeing that the time of the occurrence of precipitation goes far to determine what crops may be grown safely, that is, with a certainty of their reaching maturity, as well as with profit. Throughout the Union of South Africa, the annual

precipitation varies enormously in quantity, ranging from over 200 inches per annum in the mountainous region in the south-west, north of Stellenbosch, to less than a third of an inch at Walfish Bay, but generally speaking, the rainfall may be said to be heaviest in the east, decreasing westwards.

Seasonal Distribution.—When the percentage amount of rain falling during the six warmest months, October to March, and during the six coldest months, April to September, is calculated for various places throughout the Union, and the results plotted on a map (*q.v.*), it is found that the country may be divided into three distinct regions:

1. *Summer Rainfall Area* having over 50 per cent. of the total rainfall from October to March.
2. *Winter Rainfall Area* having more than 50 per cent. of its rain occurring between April and September.
3. *Constant or All-the-year-round Rainfall Area* having its precipitation equally divided between these two periods.

This last region, that of Constant Rainfall, as will be seen from the accompanying map, is confined to a comparatively small area, comprising part of the south coast and southern Karroo; it extends from a point some distance east of Mossel Bay to Humansdorp and stretches inland to the neighbourhood of Uniondale.

The 50 per cent. line, separating the Summer and Winter Rainfall Areas, starts on the 28th parallel of latitude in about 17° 14′ E. longitude, and runs in a general south-south-east direction to the neighbourhood of Ladismith (latitude 33° 29′ S., longitude 21° 17′ E.) then turns in an easterly direction reaching the west at Port Alfred. All the land to the north and east of this line lies within the Summer Rainfall Area and all to the south and west to the Winter Rainfall Area, with the exception of the Area of Constant Rains already referred to. It follows, therefore, that the whole of the Orange Free State lies well within the area affected by the summer rainfall.

So far as can be ascertained the average precipitation over this Province is approximately 24 inches, of which amount more than three-fourths falls during the summer six months of October-March. Speaking generally, however, the amount of rainfall decreases from east to west; thus, the mean of the last three years shows over 30 inches in the districts of Harrismith, Frankfort, and Ficksburg, decreasing to about 14½ inches in the Jacobsdal division. A similar decrease is shown if we consider individual stations having records for much longer periods; thus Alma, in the Ladybrand District, shows an average of 28.1 inches; Thaba 'Nchu, 25.1 inches; Glen Lyon and Poundisford, in the neighbourhood of Bloemfontein, 19.5 and 20.0 inches respectively; and Jacobsdal, 18.8 inches.

Not only does the normal precipitation show considerable variation in different parts of the country, but the rainfall at individual stations fluctuates considerably from year to year.

A line drawn through the various places having an average rainfall of 15 inches is ordinarily assumed to be the dividing line between the arid and semi-arid areas and the more favoured regions. This 15-inch isobyst, or line of equal rainfall, may be roughly indicated as extending from the neighbourhood of Campbell, about 60 miles west of Kimberley, in a south-south-easterly direction to the neighbourhood of the Fish River to the north of Grahamstown; thence

eastwards along the Lange Kloof, on the north side of the first mountain range parallel with the south coast to the neighbourhood of Worcester; then up the Hex River Valley to the foot of the Matroosberg; afterwards it runs northwards parallel with and on the east side of Cedarberg to the neighbourhood of Clanwilliam; it then turns southwards, west of Piquetberg, ending practically on the northern shores of Table Bay. To the north and west of this line lie the arid and semi-arid regions of the Union, although a few isolated patches within this area might more properly be considerd as belonging to the sub-humid regions. Although Bloemfontein, where a series of thirty years' observations—since 1879—shows an average rainfall of 22.8 inches, lies well to the east of this line within the more humid area, it occasionally happens during dry years that the total annual rainfall falls below this 15-inch limit. Thus, during 1903 and 1908 the total amounts recorded were 14.4 and 14.9 inches respectively, thus bringing it within the semi-arid region; while during 1897 the total precipitation was 15.2 inches, thus bringing Bloemfontein very close to this border-line. The wettest year was 1891 with 34.6 inches, or almost 52 per cent. more than the normal, whereas the driest year, 1903, with 14.4 inches, was 37 per cent. below the average. The possibility of the occurrence of such relatively small quantities affords good and reasonable grounds for adopting the principles and methods of dry-land farming, even in places having a normal annual rainfall as high as that of Bloemfontein or even higher. Large as are the extreme fluctuations in the case of a station having a rainfall as high as 22.8 inches as at Bloemfontein, it would appear to be a general rule that the smaller the average rainfall the more uncertain and precarious it is from year to year. For example, Kenhardt, in the Cape Province, shows, as the result of thirty years' observations, a normal annual rainfall of only 5.8 inches; the actual totals, however, varied between 10.12 inches, or 73 per cent. above the average in 1903. This minimum of 0.72 inches followed on a total of 2.75 inches in 1902, a condition which would present an exceedingly tough problem for even the most experienced dry-land farmer to overcome. Again, a twenty-six years' record taken at O'okiep, in Namaqualand, gives a normal annual of 6.9 inches, varying from the minimum of 3.47 inches, or 50 per cent. less than usual in 1896, to the maximum of 11.70 inches, or 70 per cent. above the average in 1892.

The disadvantages attending a small rainfall may, however, be counterbalanced to a great extent by its occurrence at a suitable period of the year. Thus in the neighbourhood of O'okiep it has been found that fairly good crops can be successfully grown with a rainfall of 6 inches or even less, whilst a rainfall of 9 inches is expected to yield a 50 per cent. heavier crop than one with only 6 inches. The conditions of success would appear to be: (1) That the bulk of the rain should have fallen and be in the ground before the seed is sown; and (2) that a few showers, well distributed as to time, should fall during the period of growth; in other words, the major portion of the total precipitation must occur between May and October. The land is allowed to lie fallow for three years. From what has just been stated with regard to the variation in the amount of rainfall from year to year in this neighbourhood, it naturally follows that success cannot be looked for on every occasion, but it is said that one good year compensates for two or three bad years. In

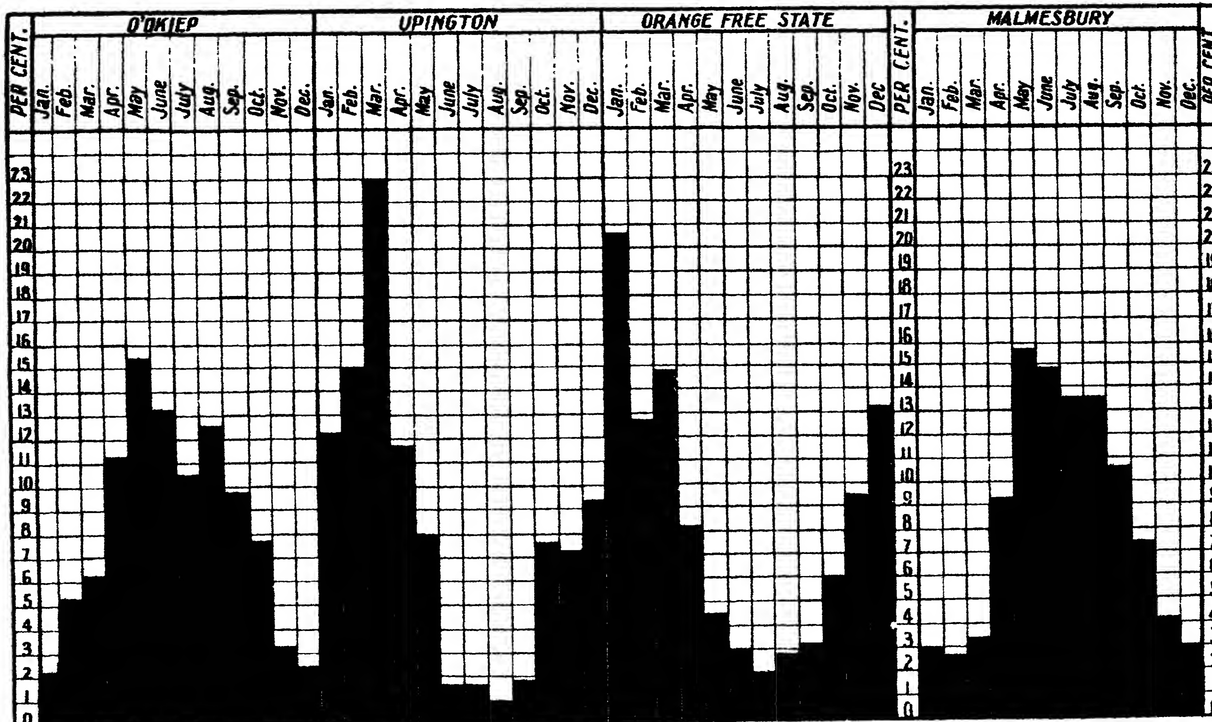


FIG. I. FIG. II. FIG. III. FIG. III. A.

Diagrams showing the Percentage Distribution of Rainfall at:—Fig. I. O'okiep (winter rainfall area. arid region). Fig. II. Upington (summer rainfall area. arid region). Fig. III. Over the Orange Free State (summer rainfall area. sub-humid region). Fig. IIIA. Malmesbury (winter rainfall area, semi-arid region).

considering the success attained in this part of Namaqualand, it must be borne in mind that about 73 per cent. of the total rainfall occurs during the winter months, April-September, when temperature and evaporation are low, the skies cloudiest, and the air most humid; whereas at a place like Upington, in Gordonia, which lies within the Summer Rainfall Area, with an almost equal annual rainfall (73 inches) only 26 per cent. falls during these same winter months. This difference in distribution is perhaps better shown by the accompanying diagrams (Figs. I and II) in which are depicted the percentage distribution of the precipitation at O'okiep and Upington throughout the year. Reasons will subsequently be adduced for believing that a given amount of rain has a lower agricultural value over the Summer Rainfall Area under natural conditions. The following table showing the mean monthly temperature and rainfall at O'okiep (3036 feet) and Kenhardt (1700 feet) will serve to show some of the differences in climate over the Winter and Summer Rainfall Areas respectively. (The mean temperatures are also shown diagrammatically in Fig. IV.)

Station.		Jan.	Feb.	Mar	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov	Dec	Year
O'okiep	Temperature (Fahr.).	71·0	72·1	70·2	66·7	59·3	53·5	53·0	54·0	57·4	61·5	65·0	70·1	62·8
	Rainfall (ins.)	0·2	0·4	0·4	0·8	1·1	0·9	0·7	0·8	0·7	0·5	0·2	0·2	6·9
Kenhardt	Temperature (Fahr.)	78·4	78·6	74·8	66·2	58·4	52·2	51·3	55·8	61·5	67·5	71·4	78·4	66·2
	Rainfall (ins.)	0·6	1·2	1·1	0·7	0·4	0·3	0·1	0·1	0·2	0·4	0·3	0·4	5·8

In this connection, it may be of some interest to give the following description by Professor Brewer of the *ideal* climate for wheat: "The ideal climate for wheat is one with a long and rather wet winter, with little or no frost, prolonged into a cool and rather wet spring, which gradually fades into a warmer summer, the weather growing gradually drier as it grows warmer, with only comparatively light rains after the blossoming of the crop, just enough to bring the grain to maturity, with abundant sunshine and rather dry air toward the harvest, but without dry and scorching winds until the grain is fully ripe, and then hot, dry, rainless weather until the harvest is gathered."

These conditions are more nearly realized in the west of the Cape Province than in any other part of the Union. He adds: "It is here that certain varieties of very hard wheats only grow in hot, dry climates. Such is said to be the case with the best macaroni wheats" (durum wheats).

Seeing that comparisons are frequently drawn between this country and the United States of America, it may be advisable to define more precisely and to adopt the various descriptive terms employed in connection with different regions there. Thus, basing the statement on average rainfall alone, it is customary to call those areas having less than 10 inches per annum, *arid* regions; those with 10-20 inches, *semi-arid*; those having 20-30 inches, *sub-humid*; and those with over 30 inches, *humid*. From what has been already stated

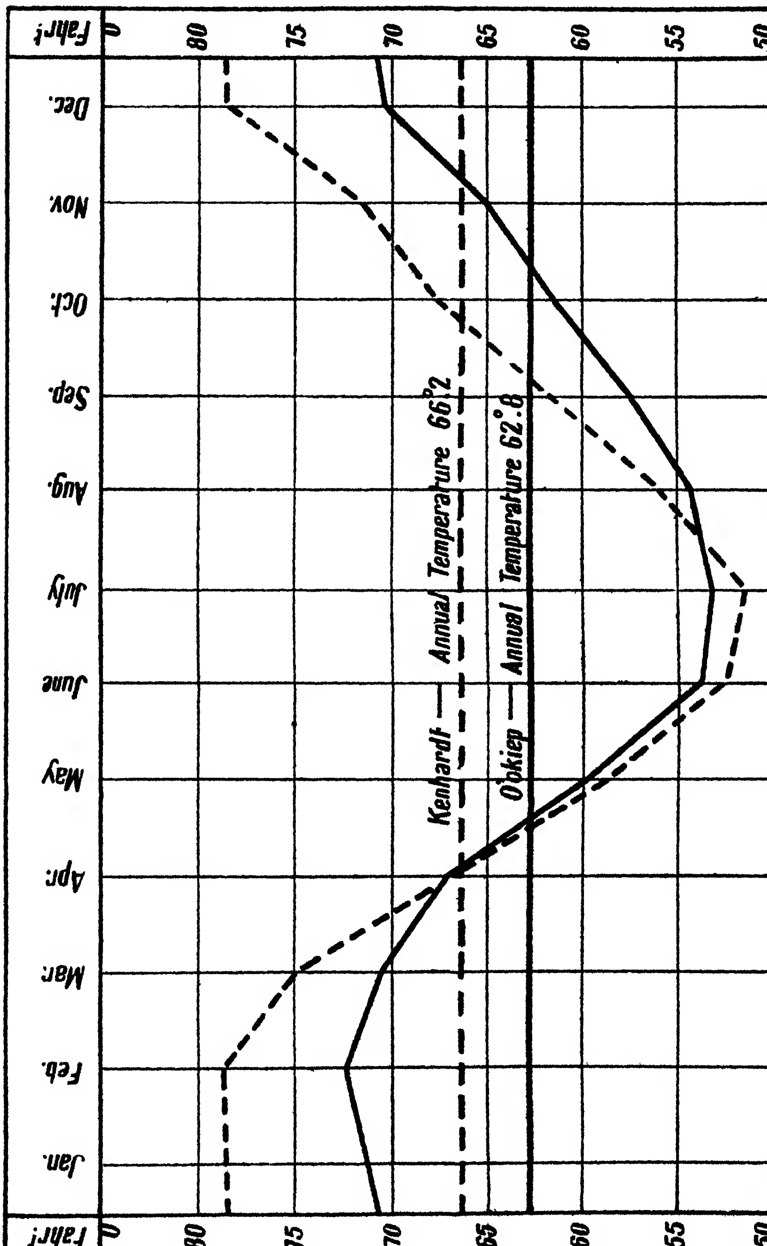


Fig. IV. Mean Monthly Temperature at O'okiep ———
" " " Kenhardt - - - -

with reference to the normal rainfall over the Orange Free State, it will be understood that the various districts range from what are practically humid areas in the east (e.g. Harrismith, Ficksburg, etc.) through sub-humid over the greater part of the country to semi-arid areas in the west (Boshof, Jacobsdal, Fauresmith).

The following table, showing the monthly rainfall, number of rain-days, and the percentage monthly fall in terms of the annual precipitation, may be taken as an approximation to the average conditions prevailing over the Free State throughout the year:—

	Jan.	Feb.	Mar	Apl.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.	Year
Average Rainfall in inches	4·91	3·02	3·50	1·95	1·04	0·70	0·48	0·69	0·73	1·42	2·23	3·16	23·83
Average No. of Rain-days	9	7	8	5	3	2	2	2	2	3	5	7	55
Percentage of Annual Fall	20·6	12·7	14·7	8·2	4·4	3·0	2·0	2·9	3·1	6·0	9·4	13·2	—
Average Intensity (inches)	0·55	0·43	0·44	0·39	0·35	0·35	0·24	0·34	0·36	0·17	0·45	0·45	0·43

It will be seen from the above that the rainfall is greatest during January and decreases to a minimum in July, after which it increases once more to the end of the year, over 76 per cent. falling during the summer months.

In a country like South Africa which is subject to seasonal rains it is usual to describe vaguely certain months as wet and others as dry, but evidently such descriptive terms are merely relative and will be applicable to different quantities, depending on the average annual rainfall at the place under consideration for the time being. In order to arrive at greater definiteness in the use of these terms, wet and dry, as applied to the months of the year it is necessary to adopt some standard. The most feasible plan would seem to be to assume a uniform distribution of rainfall throughout the different months of the year as a basis of comparison. If the annual precipitation be taken as 100, it follows, on the assumption of a uniform distribution, that one-twelfth of 100, or 8.33 per cent., ought to occur during each month, and any departure above or below this percentage will entitle such a month to be termed wet or dry, as the case may be. Thus a month with 12.5 per cent. of the annual total would be *wet* and one with 16.7 per cent., *very wet*; whereas one with only 4.2 per cent. would be termed *dry*, and one with only 2.1 per cent., *very dry*. A month having 8.33 per cent. might be termed *normal*. By the introduction of other suitable modifying terms, as moderately wet or moderately dry, it becomes possible to describe the characteristics of each month with regard to precipitation with a fair degree of precision. Thus, in the case of the Orange Free State, we can say that June to September are *very dry*; October as *moderately dry*; November as slightly *above normal*; December to March as *wet*; January being *very wet*; April as *normal*; and May as *dry*.

In that part of the South African Union included in the Summer Rainfall Area, it is impossible to overestimate the importance of the spring and early summer rains, as on the timely arrival of these

depends the time of sowing seeds. No attempt has been made to determine the average dates of the commencement of the rains, but in some cases they come earlier and in others later according to position, while even at the same place the date of their arrival varies considerably from year to year. Thus our examination of the records shows that not only is there a considerable variation in the amounts which fall at different stations in the Free State during September and October, but it is not at all unusual for the rains to fail altogether during these months, and even occasionally those of November. This is not to be wondered at when it is borne in mind to what extent these rains are dependent on the occurrence of thunderstorms which are frequently very local and to all appearance pursue somewhat erratic courses. Of course a drought occurring during these months would be considerably intensified by the failure, partial or complete, of the previous autumn rains. It follows then that with an uncertain and precarious spring and early summer rainfall, it is essential that every endeavour should be made to conserve what actually does fall at this time. If the usual occurrence of heavy rains about the time of the ripening of the crops be also taken into consideration, it will be readily understood that the distribution of rainfall throughout the year over the Orange Free State is extremely unfavourable to the farmer, while the danger of the destruction of crops from severe hailstorms adds to the difficulties to be faced.

The depth to which rain will penetrate into the soil depends not only on the nature of the surface and the humidity of the upper layers, but also on the intensity and frequency of the precipitation, so that it is important to ascertain the number of rain-days and the average amount falling at one time (i.e. the intensity) in order that an estimate may be formed of the amount likely to be available for the sustenance of plants. The fourth line of Table II shows the mean intensity of rainfall from month to month, the results having been arrived at by dividing the actual rainfall by the number of rain-days. From this it will be seen that the intensity is greatest (0.55 inches per rain-day) in January and least (0.24 inches) in July, while during October-March it is mostly about the mean of the year. The greatest number of days of its occurrence is in January and the least in June to September. Of the rainfall reaching the ground, a large proportion is usually carried off by surface drainage, especially during thunderstorms, part penetrates into and percolates through the soil to reappear as springs or fountains; a proportion is retained between the particles of the soil, and part passes off by evaporation into the air again. The main object of dry-land farming operations is to enable as large an amount as possible to pass into the soil by the proper and timely preparation of the ground, and to reduce evaporation from the soil to a minimum so that the largest possible amount may be made available for the growth of crops. Unfortunately, Nature, as will be shown later, appears to have arrayed her forces so as to defeat man's most strenuous efforts in this direction.

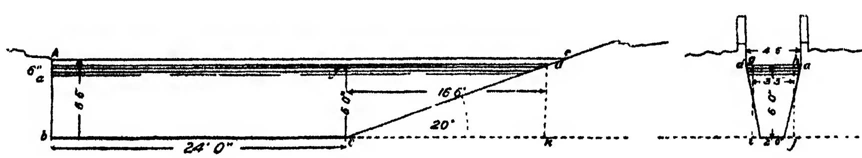
(To be continued.)

The Capacity of a Dipping Tank.

THE following note on a method of ascertaining, by measurement, the capacity in imperial gallons of a cattle dipping tank has been supplied by Mr. D. Canty, cattle guard at Kalkfontein, Zoutpansberg District, Transvaal:—

Let us first suppose the dipping tank to be filled with water to a depth of 6 feet, that is to say, to the top of the sloping sides. When the tank is so filled the water-line will stand at *a d*, as shown in the longitudinal section, and at *a′ a′* in the transverse section (see accompanying diagram).*

Multiply the length of the level bottom of the tank (24 feet) by the height of water in the tank (6 feet) and the product by the mean width of the tank (3 feet 3 inches). The mean width is easily found by adding 2 feet to 4 feet 6 inches and dividing the sum by 2. By finding the mean width in this way we are really converting the wedge-shaped body of the tank into a figure which can be easily measured and which is shown in the transverse section lettered *g h i j*. This figure is similar in shape to a matchbox standing on one of the sides upon which the matches are ignited. A glance at the transverse section will satisfy any one that it is exactly equal in bulk to the wedge-shaped body of the tank. This is the figure which we are about



to measure or compute the cubic contents of, and in doing so we will have found the contents of the wedge-shaped body of the tank, since both figures are exactly equal:

$$24 \times 6 \times 3\tfrac{1}{4} = 144 \times 3\tfrac{1}{4} = 468 \text{ cubic feet.}$$

Now multiply 16 feet 6 inches (the length from *f* to *d*) by the height of water in the tank (6 feet) and the product by 3 feet 3 inches (the mean width). We thus determine the contents, capacity, or bulk of a second matchbox-shaped solid shown in the longitudinal section and lettered *c f d k*. We only require to find the bulk of half of this solid or figure and must therefore divide by 2. It would, of course, amount to the same thing were we to multiply 8 feet 3 inches (half of 16 feet 6 inches) by 6 feet and the product by 3 feet 3 inches. Let us, however, pursue the first method, thus:—

$$16\tfrac{1}{2} \text{ feet} \times 6 \text{ feet} \times 3\tfrac{1}{4} \text{ feet} = 99 \times 3\tfrac{1}{4} = 321\tfrac{3}{4} \text{ cubic feet.}$$

$321\frac{3}{4} \div 2 = 161$ cubic feet, which added to 468 cubic feet $= 629$ cubic feet. This is the cubic contents, or simply the bulk of water in the tank when filled to a depth of 6 feet.

* The dipping tank represented is that shown in Farmers' Bulletin No. 23, by R. W. Dixon, M.R.C.V.S.

A cubic foot of water $= 6\frac{1}{4}$ gallons. Therefore to find the capacity in gallons multiply $629 \times 6\frac{1}{4} = 3931$ *imperial gallons.*

Let us now imagine the tank filled up to A, that is until the water is 6 feet 6 inches deep. We have now added a layer or, if I may so say, a slab of water of a uniform width (4 feet 6 inches). Its depth or height is 6 inches and its length lies *somewhere* between $a\ d$ and $A\ e$. Indeed, either of these measurements may be taken as the length of this layer of water, unless strict accuracy be sought for. If the exit-slope were 45 degrees, then half the thickness of the layer would have to be added to $a\ d$, or substracted from $A\ e$, in order to find the exact length of this layer or slab. The exit-slope being in this instance only 20 degrees we must add $1\frac{1}{3}$ of the thickness of the layer of water (8 inches) to $a\ d$ or deduct 8 inches from $A\ e$, thus:

$$24 \text{ feet} + 16 \text{ feet } 6 \text{ inches} + 8 \text{ inches} = 41\tfrac{1}{6} \text{ feet.}$$

$$41\tfrac{1}{6} \times 4\tfrac{1}{2} \times \tfrac{1}{2} = \frac{741}{8} = 92\tfrac{5}{8} \text{ cubic feet (cubic contents of added layer 6 inches thick).}$$

$$92\tfrac{5}{8} \times 6\tfrac{1}{4} = \frac{741}{8} \times \frac{25}{4} = 579 \text{ imperial gallons.}$$

If this amount be added to the number of gallons already found, we will then have found the capacity of the tank when filled up to A:

$3931 + 579 = 4510$ *imperial gallons.*

Early Harvesting of the Maize Crop to Minimize Loss from Early Frost.

By JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

MUCH of the South African maize crop is likely to be very late in maturing this year owing to the abnormally dry spring which delayed germination and growth of the plants till a phenomenally late period. In consequence of this it is probable that much of the high veld crop will be in danger of injury from the first frosts. If these hold off, as they did last winter, much of the crop will probably be safe, but if they begin as early as in many years, it will be necessary to *cut the crop before it is fully ripe* or dry to prevent loss. This is a common practice in those parts of the United States where the autumn and winter are wet and where the frosts are early and severe.

The experience of growers has shown conclusively that the maize grain will continue to draw a considerable amount of "filling" from the stalk for a long time after the latter has been harvested, provided

the plants have reached a certain stage of development. The farmer can take advantage of this fact to harvest his maize crop before it is fully ripe; if placed in "stooks" in the field it will be quite safe from the effects of such frosts as we get in South Africa. *Provided the maize is sufficiently matured* at time of cutting, there is very little difference in the yield and quality of grain between maize cut and shocked, and that left standing.

The stage of maturity at which the crop should be cut under normal conditions will depend on the use which is to be made of the crop, as indicated below:—

Seed Maize.—For seed purposes the breeding plots should be allowed to stand until the stalks are quite dry.

Commercial Grain.—For commercial grain the crop may be cut when the ear is well ripened, the husk being quite brown and dry and a few of the leaves being dry; at this stage of growth the grain has reached the point where it provides the highest yield combined with best condition for utility.

For Stover, only, it has been found that the crop attains the highest yield combined with best condition for feeding, at the stage of growth indicated by the *first drying* of the leaf blades and by a well-dented grain (in a dent breed such as Hickory King) or a well-glazed grain in a flint breed such as Cango.

For Grain and Stover.—Where it is desired to secure the best results with both grain and stover, a stage of ripening intermediate between that recommended for commercial grain and that for stover is desirable. In other words, to get the full advantage of the maize crop for both grain and stover, harvest it when the husks are quite dry, when the grain is well dented or glazed, but before the ears are thoroughly ripened, and when the leaf blades are from one-third to one-half green.

A useful instrument for hand-cutting the crop is the cane-knife sold by hardware merchants for cutting the sugar-cane crop; it has the advantage of being heavy enough to cut through a maize stalk almost with its own weight, thus reducing the amount of muscular labour exerted by the boys and increasing their working capacity.

The Establishment and Cultivation of a Vineyard.

By Dr. A. I. Perold, Government Viticulturist.

(*Continued from page* 301.)

Under the treatment of the vine itself still falls the

Summer Treatment.

Here I shall briefly touch on the following points only:—(1) Topping, (2) removing of shoots, (3) treatment against the non-setting of berries, (4) thinning out of grapes, (5) partial removal of leaves, (6) removing of roots of *Vitis vinifera* (European vine).

(1) *Topping.*—In this country farmers are as a rule inclined to top too much. Young vineyards, especially those grafted on the spot, must be kept short (shoots to 1 ft. long) to prevent the young shoots from being blown off by strong winds. One should here in every case top short regardless of the position of any fruit. Vineyards in the second or third leaf should likewise be topped short, as also here one should try to keep the main shoots in order to have the necessary bearers at their right places when the next pruning is done. This mainly applies to those districts where, especially in September and October, strong winds prevail. Old vineyards must also be topped short up to November in order as much as possible to prevent the shoots from being blown off. From after the 15th November one should not top their vineyards any more, or only very little. One should never forget that a good development of shoots is of great value to the vine itself. One, therefore, only tops for reasons making it a necessity. The above is meant for vineyards which are not trellised on wire or stakes (one at every vine). With stakes or wire trellises one shall practically never have reason to top before late in October, as one must in this case wait till the shoots are 6 in. to 1 ft. above the stakes or top wire.

(2) *Removal of young shoots.*—This is done in very many wine districts of Europe. Hereby all young shoots without grapes are removed, as also those which are not required as bearers for the next year. It stands to reason that one must here use common sense, and not remove any or very few shoots from weak vines. It will be advantageous to vigorous vines to have their superfluous shoots removed. In case one should believe a vine to bear too much, shoots with grapes or grapes alone can be removed. Often one hears that this removal of shoots weakens the vines. Where the removing of shoots is indiscriminately done, and the shoots of weak vines are removed, which already scarcely have sufficient shoots, this work can have such detrimental effects. Where the vineyard, however, is vigorous, and the vines have quite a lot of superfluous shoots, both the grapes, the shoots, and the vines will profit by removing all unnecessary shoots as soon as the grapes are well visible.

One should not say that this work causes too much trouble, as the shoots then removed must otherwise be cut when lignified. Thus one should here speak of less and not of more work.

In conclusion, I must warn against removing the shoots too late, as one is then sure to weaken the vines in the long run. This work should be done when the shoots are still tender (not lignified).

(3) *Treatment against the non-setting of the berries.*—This non-setting or "running off" is one of our greatest difficulties in growing Hanepoot and some other varieties.

This running off can be caused by

(*a*) unfavourable weather (rain and cold during the flowering season);
(*b*) a too vigorous growth (extremely vigorous vines) and too much moisture in the soil;
(*c*) the variety of grape (for instance, Hanepoot is very much more subject to it than Muscadel);
(*d*) the American graft-bearer.

The weather, of course, one cannot change. It is, however, a fact, that rain and cold are the main reasons for this "running off." That is why one finds the same variety of grape running off much less in certain sheltered places than when exposed to the inclemencies of the weather. Further, one finds certain patches and even certain vines in your vineyard which run off year after year. It may in such cases be that the running off lies either in the nature of these vines themselves, and then one must regraft these vines, or it may be that they are too vigorous, and then they should be pruned late and given many and long bearers (three to four eyes).

At the same time the vines may also be treated according to the following methods. One of the best methods to prevent "running off" is to *ring-bark* the shoots. According to Föex, one removes a ring of the bark of the internode just under the last bunch of grapes. This is done by means of ring-barking shears, whereby the bark is cut through all round the shoot. One should take special care not to cut too deep, as otherwise the external wood-fibres under the cambium will also be cut. This might cause the supply of water to be so much hindered that the part above the ring-wound will gradually wither and die off. Of the various kinds of shears for ring-barking, I prefer those that regulate the cutting automatically, and with which one cannot easily cut too deep. As soon as the ring is loose, one stops turning (cutting). Although there exists some difference of opinion on this point, it seems that the most favourable moment for ring-barking is when flowering just sets in, i.e. as soon as a few flowers have opened here and there. In case of vines with long bearers (six or more eyes), Ottavi (*Viticoltura practica*, p. 892) recommends making the ring-wound at the base of the long bearer. Hereby one makes only one ring-wound instead of six or more. Moreover, this is made on wood that is removed during the following pruning season, whilst the future bearers remain uninjured. This system has given very satisfactory results in Italy for more than twenty years. Some experiments on the influence of the ring-wounds may here be quoted from Ottavi, loc. cit., p. 896:—

(*a*) An even number of vines was selected for each experiment. Of these one-half was ring-barked, whilst the other half remained untouched.

	Untreated.	Treated.
Old vines	150 bunches	125 bunches
After 40 days	54 ,,	122 ,,
Loss	96 ,,	3 ,,
Young vines	116 bunches	120 bunches
After 40 days	80 ,,	115 ,,
Loss	36 ,,	5 ,,

(b) An experiment with old vines of Barbera (grape), which ran off badly, was made in 1906:

35 vines treated gave 182 lb. of grapes.
35 vines untreated gave 85 lb. of grapes.

The crop was thus increased through ring-barking by 97 lb., or 114 per cent. This clearly proves the advantage and efficiency of ring-barking. The ring-barked shoots of vines standing free can easily be blown off by strong winds. This difficulty disappears in case of trellised vines.

Another way to combat "running off" which is strongly recommended by Ottavi (loc. cit., pp. 890-891) is to let the vines bleed freely. This simply means, that at the tip of the long bearers a bit of the cane is cut away (less than half an inch), when the eyes have already all budded. The vine will start bleeding much from the wound. After four to five days this is repeated. Where necessary this must be repeated four to five times, in some cases till eight times. This method is good in a moist spring, but in a dry spring it cannot be recommended. It also is a tested and efficient means to prevent "running off."

For the rest the vineyard must at this time of the year be kept clean and dry (hence also warm) and short. While flowering, the vines should be sulphured. By this topping and sulphuring the "running off" is prevented to a fair extent.

Where the "running off" is due to faulty fertilization—this is frequently the case where the style is very much longer than the stamens, as, for instance, is the case with the Ohanez grape—one can get good results by rubbing the bunches while flowering with a flowering bunch of another variety (*Aramon rup.* and other American vines are also suitable) or even by gently passing over the flowering bunches with a soft woollen brush. This is largely done in Almeria to fertilize the Ohanez artificially and to secure a good crop. Otherwise this variety is very much inclined to run off.

Very little is so far known about the influence the graft-bearer (American stock) has on the "running off." In this country the Le Roux Rupestris ("Donkey") causes the Hanepoot to run off very much, as soon as the weather becomes unfavourable. This question, however, has still to be studied.

(4) *The thinning out of the bunches.*—This is only important in case of table grapes, and especially for the best varieties. Every one who exports grapes will at once appreciate the value of thinning out. By thinning out, a loose bunch with *big and sound berries* is obtained, which are all more or less of *the same size*. Table grapes for export must possess the above-mentioned qualities in order to fetch a high price. The ends of the long bunches (Hanepoot, Barbarossa) must

also be cut off to give the bunch a better shape and to let the berries ripen more or less at the same time and to enable them to colour up well.

This thinning out should be started with as soon as the largest berries are the size of a pea. In the first place, all small, not satisfactorily fertilized berries are taken away. Then, according to the size of the grown-out berries of the special variety of grape, one-quarter to one-third of the remaining berries are removed to enable the other berries to grow to their maximum size. One will find that the grapes remain much healthier in loose than in compact bunches.

To thin out bunches when ripe and on the point of being packed is radically wrong, as then none of the advantages of thinning out are obtained, whilst sound berries are easily injured (often without noticing it!), which then easily rot and infect the remaining berries and bunches. From time to time the table grapes for export have to be examined and all bad berries removed. When the bunch is ripe and is cut for export, one *should be able to pack it directly as it is.* The person who does this properly will obtain good prices in foreign countries, even for Hermitage. For really first-class grapes one will always get good to very high prices in foreign countries, whereby one is more than compensated for all the trouble taken. Then, of course, only first-class grapes should be exported. Now, still some hints on the thinning-out itself. This work is done with narrow, pointed scissors, which are specially made for this purpose. When thinning out one should not twist the bunch (one should bend oneself) or injure the stalk with the sharp points of the scissors. Further, the bunch should be given a good shape, and the berries carefully cut away in such a manner as to have the remaining berries evenly distributed over the bunch. By thinning out when the grapes are still green the ripe grapes need afterwards not to be handled much. *They thus retain their bloom*, which in case of first-class table grapes is a thing of great importance.

Thinning out is simply absolutely necessary in order to secure high or fancy prices for export grapes on foreign markets.

(5) *Partial removal of leaves.*—In case of very vigorous and close vines it is a good thing to remove some of their leaves to allow more light and air to pass through the vine. Here one should never forget that the leaves are the lungs of the vines, and hence should not remove more leaves than necessary. When the grapes are already fairly ripe, and moist and rainy weather prevails, the lower leaves should be plucked to prevent the grapes from rotting and to further the process of ripening.

In Sauternes it is customary to remove the leaves from the bottom to the second internode above the top bunch of grapes as soon as the grapes are *ripe*. At this stage they will not be burnt any more. The berries will here and there become raisins. The leaves can be removed on two occasions. The first time the leaves on the southern side are removed and the remainder some days later. It is absolutely essential to leave at least four leaves to each cane. These leaves can still form some sugar, but their main function is to ripen the cane and to form reserve materials for the roots. The main object in removing some of the leaves when the grapes are ripe is to concentrate the sugar in the berry at the expense of the quantity of the must, as the berries hereby shrink somewhat and here and there become

raisins. In such a way I increased the sugar of ripe green grapes from 24° Balling (when the leaves were removed) to 29½° Balling (when the grapes were pressed) in fourteen days. From these grapes a very good dry and heavy sherry has meanwhile been made, with an alcoholic strength of 17 vol. per cent. without any fortification.

(6) *Removal of the roots of the "Vinifera" (European vines).*—It is not necessary to say much about this subject. It is clear that in case the roots of the "vinifera" (European vine) are left growing, the roots of the American stock will be unsatisfactorily fed till at last they will die off. Then the European vine stands on its own roots and may at any time be killed by phylloxera. To prevent this one must from time to time remove the roots of the vinifera, so that the vine is only supplied with food by the roots of the graftbearer. In case of grafts the roots of the scion are only removed in December or January, as they then at the start stand a better chance of growing on the graft-bearer, and later (during October and November) there will be less danger of the wind blowing off the young shoots.

List of pamphlets by the author which were referred to in this article and which can be obtained from the Office of the Government Viticulturist, Paarl:—

(1) "Drainage" (*Agricultural Journal of the Cape of Good Hope*, November, 1910).
(2) "Raisins" (*Agricultural Journal of the Cape of Good Hope*, February, 1910).
(3) "Manuring of Vineyards" (*Union Agricultural Journal*, July and August, 1911).
(4) "The Principal Diseases of our Vineyards" (*Agricultural Journal of the Cape of Good Hope*, October, 1910).
(5) "Report of American Stocks Commission" (*Union Agricultural Journal*, July and August, 1912).

Analyses of Prize Wines.

The following are reports by the Senior Chemist (Mr. J. Muller), Government Analytical Laboratory, Capetown, on analyses of sixty-eight samples of prize wines in connection with the Capetown show of wines and brandies held on the 17th and 18th October last:—

GROWERS' CLASSES—VINTAGE 1912.

WHITE WINES.

No.	Prize. Description.	Extract.	Alcohol by Volume. %	Total Acid as Tartaric Acid.	Volatile Acid as Acetic Acid. per milligramme.	Sulphurous Oxide in milligrammes per litre.
	Class I. Light dry White Wine.					
1	1st, C. W. H. Kohler	1·27	12·49	·600	·528	114
2	2nd, James Malan	2·02	12·77	·394	·438	28
3	3rd, P. J. Rabie	1·94	14·09	·487	·666	100
	Class II. Sauterne type.					
4	1st, P. J. P. Rabie	2·12	12·96	·525	·978	95
	Class III. Sherry type (dry).					
5	1st, P. J. P. Cillie	2·28	13·15	·581	·786	252
6	2nd, Klein Constantia Estate ...	2·25	13·99	·881	·14	136
7	3rd, Edward Lange	2·45	13·99	·712	·708	17
8	h.c., O. Rathfelder	2·29	13·24	·806	·462	22
	Class IV. Madeire type.					
9	1st, G. J. Krige & Sons	21·45	13·34	·544	·846*	30
	Class V. Sweet White Muscadel.					
10	1st, P. J. Rabie	28·12	13·24	·394	·240	20
11	2nd, Philip Rabie	28·09	14·09	·394	·330	40
	Class VI. Stein.					
12	1st, Dr. Brown	1·93	13·43	·619	·416	98
13	2nd, James Malan	2·02	13·34	·581	·600	50
14	3rd, Edward Lange	2·45	13·90	·721	·576	15
	Class VII. Green Grape.					
15	1st, C. W. H. Kohler	2·01	12·22	·637	·546	139
16	2nd, Edward Lange	1·35	11·87	·562	·438	48
17	3rd, Louw Bros.	2·14	12·77	·562	·726	30
	Class VIII. White French.					
18	1st, P. J. Rabie	1·92	13·62	·469	·774	113
19	2nd, Drakenstein Co-op. Winery ...	2·43	12·58	·600	·630	106
20	3rd, Dr. Brown	2·04	11·44	·712	·438	88
21	h.c., Klein Constantia Estate ...	2·04	11·96	·731	·444	71
	Class IX. Riesling or Sauvignon Blanc.					
22	1st, Drostdy Co-op. Winery	2·06	11·26	·787	·810	166

RED WINES.

No.	Prize. Description.	Extract.	Alcohol by Volume. %	Total Acid as Tartaric Acid.	Volatile Acid as Acetic Acid, per milligramme.	Sulphurous Oxide in milligrammes per litre.
	Class X. Claret type.					
23	1st, Dr. Brown	2·30	12·05	·581	·534	40
24	2nd, Drakenstein Co-op. Winery ...	2·33	12·49	·544	·576	31
25	3rd, Alphen Winery	2·27	11·87	·694	·636	17
	Class XI. Burgundy type.					
26	1st, Alphen Winery	2·26	11·87	·600	·612	14
27	2nd, High Constantia Estate ...	2·51	11·70	·581	·642	16
28	3rd, F. F. Versfeld	5·58	12·58	·525	·696	19
	Class XII. Heavy dry Red Wine of Port type.					
29	1st. Drostdy Co-op. Winery	5·29	19.49	·487	·708	13
	Class XIII. Sweet Red Muscadel.					
30	1st, P. J. Rabie	28·25	15·86	·394	·300	20
31	and Philip Rabie...	27·77	16·33	·356	·240	18
	Class XIV. Hermitage (dry).					
32	1st, Dr. Brown	2·26	12·49	·544	·576	31
33	2nd. R. Cloete...	2·16	12·05	·600	·810	30
34	3rd, A. W. Spilhaus	2·25	12·49	·525	·630	13
	Class XV. Cabernet de Sauvignon (dry.)					
35	1st, A. W. Spilhaus	2·42	12·40	·637	·582	23
36	2nd. R. Cloete...	2·56	12·40	·581	·798	20
37	3rd, Dr. Brown	2·62	11·87	·525	·594	35
	Class XVI. Pontac (dry).					
38	1st, Louw Bros.	3·69	11·56	·487	·780	24
	SPECIAL PRIZES.					
	Class XX ("Jagger Cup"). Light White Wine.					
39	C. W. H. Kohler	1·92	12·22	·381	·588	112
	Class XXI ("Wine Merchants' Cup"). Light dry Red Wine.					
40	F. F. Versfeld	2·41	13·15	·562	·672	32
	Class XXII ("Kohler Cup"). Light White Wine.					
41	C. W. H. Kohler	1·84	12·40	·600	·522	122
	MATURED CLASSES (OPEN), RED VARIETIES.					
	Class XXIII. Port type.					
42	1st, E. K. Green & Co.	11·69	19·78	·469	·8 8	23
43	2nd, J. Sedgwick & Co.	10·37	19·08	·525	*1·110**	28
44	3rd. Van Ryn & Co.	12·20	*20·43*	·637	*1·350**	82

MATURED CLASSES (OPEN), RED VARIETIES—(*continued*).

No.	Prize. Description.	Extract.	Alcohol by Volume. %	Total Acid as Tartaric Acid.	Volatile Acid as Acetic Acid, per milligramme.	Sulphurous Oxide in milligrammes per litre.
	Class XXIV. Burgundy type.					
45	1st, Alphen Winery	2·05	12·68	·600	*1·038*	18
46	2nd, J. Sedgwick & Co.	2·44	12·13	·619	·858	31
47	3rd, E. K. Green & Co.	2·36	13·05	·381	*1·122*	17
48	h.c., J. Sedgwick & Co.	2·14	12·96	·562	·882	18
	Class XXV. Claret type.					
49	1st, Alphen Winery	1·98	11·61	·600	·960	11
50	2nd, J. Sedgwick & Co.	2·17	12·22	·637	·954	19
	Class XXVI. Pontac (dry).					
51	1st, J. Sedgwick & Co.	8·59	*18·78*	·562	·624	28
52	2nd, E. K. Green & Co.	9·41	*22·18*	·487	·822	31

WHITE VARIETIES.

No.	Prize. Description.	Extract.	Alcohol by Volume. %	Total Acid as Tartaric Acid.	Volatile Acid as Acetic Acid, per milligramme.	Sulphurous Oxide in milligrammes per litre.
	Class XXVII. Sherry (dry).					
53	1st, J. Sedgwick & Co.	2·37	*20·33*	·600	·840	42
54	2nd, E. K. Green & Co.	2·49	*20·80*	·581	·684	17
	Class XXIX. Light dry White Wine.					
55	1st, E. K. Green & Co.	2·00	11·61	·619	·888	40
56	2nd, C. W. H. Kohler	1·76	11·35	·525	·750	70
	Class XXVIII. Sherry (sweetish).					
57	1st, J. Sedgwick & Co.	4·69	18·98	·619	·714	16
58	2nd, E. K. Green & Co.	13·05	19·08	·535	·522	23
	Class XXX. Sauterne.					
59	1st, J. Sedgwick & Co.	1·82	13·15	·619	·720	79
60	2nd, E. K. Green & Co.	1·92	11·96	·619	*·924*	118

SWEET WINES.

No.	Prize. Description.	Extract.	Alcohol by Volume. %	Total Acid as Tartaric Acid.	Volatile Acid as Acetic Acid, per milligramme.	Sulphurous Oxide in milligrammes per litre.
	Class XXXI. Red Muscadel.					
61	1st, H. C. Collison	23·36	14·27	·412	·540	31
62	2nd, Van Ryn & Co.	24·89	15·86	·431	·558	31
	Class XXXII. White Muscadel.					
63	1st, E. K. Green & Co.	24·21	19·68	·431	·558	38
64	2nd, H. C. Collison	21·55	17·59	·375	·720	42
	Class XXXIII. Pontac.					
65	1st, J. Sedgwick & Co.	21·34	19·28	·806	·442	25
66	2nd, H. C. Collison	24·89	15·49	·562	*1·338*	41
	Class XXXIV. Frontignac.					
67	1st, J. Sedgwick & Co.	24·53	17·92	·469	·426	72
68	2nd, E. K. Green & Co.	29·86	19·68	·581	·984	49

The analytical data which exceed the limits laid down are in italic figures (thus, *1·338*). Only in such cases were the reserve samples analysed.

* There appears to be no final limit laid down for wines other than dry in respect to the volatile acid content. Nos. 44, 51, 52, 53, and 54 contravene section 7 (7) of Act No. 42 of 1906.

ANALYSIS OF LIQUEURS (VAN DER HUM).

Report on the analysis of three samples of liqueur (Van der Hum) submitted by the Secretary to the Western Province Agricultural Society on the 14th October, 1912, in connection with the Capetown show of wines and brandies held on the 17th and 18th idem.

The following are the analytical data, together with description of the samples:—

Class 18.—*Van der Hum (any age).*

(*a*) 1st Prize: Drostdy Co-operative Wineries.

Class 39.—*Van der Hum.*

(*b*) 1st Prize: H. C. Collison.

(*c*) 2nd Prize: Van Ryn.

No.	(*a*).	(*b*).	(*c*).
Name of Exhibitor	Drostdy Co-op. Winery.	Collison.	Van Ryn.
Absolute Alcohol by volume, per cent.	35·51	28·86	34·04
Extract, per cent.	34·43	35·09	40·04
Saccharine	Nil	Nil	Nil
Metallic impurities	Nil	Nil	Nil

ANALYSIS ON PRIZE BRANDIES.

Report on the analysis of five samples of pure wine brandy submitted by the Secretary to the Western Province Agricultural Society on the 14th October, 1912, in connection with the Capetown show of wines and brandies held on the 17th and 18th idem.

The following are the analytical data, together with description of samples:—

Class 17.—*Pure White Brandy.*

(*a*) 1st Prize: James Malan.

Class 35.—*Pure White Brandy.*

(*b*) 1st: H. C. Collison.

(*c*) 2nd: J. Sedgwick & Co.

(*d*) R. Santhagens.

(*e*) E. K. Green & Co.

Class	17	35			
	(*a*).	(*b*).	(*c*).	(*d*).	(*e*).
Name of Exhibitor...	Malan.	Collison.	Sedgwick.	Santhagens.	Green.
Degrees under proof	5·7	20·5	20·0	19·4	21·5
In grammes per 100 *litres Absolute Alcohol:*					
Volatile Acid ...	54·4	60·0	93·4	53·0	43·0
Aldehydes ...	14·2	19·5	20·6	28·8	22·3
Furfurol	Trace	0·77	1·16	1·4	2·2
Ethers	106·4	144·2	196·8	210·0	117·5
Higher Alcohols ...	153·4	116·1	127·1	137·0	237·(?)
Total secondary constituents	328·4	340·6	439·1	430·2	422·

The above are free from saccharine and conform to the limits defined for pure wine brandy in the prize list and also comply with the provisions of the Wine and Brandy Acts of 1906 and 1908.

J. MULLER,
Senior Chemist.

Caterpillar Wilt Disease.

THE following extract from a recent departmental monthly report by the Chief of the Division of Entomology (Mr. C. P. Lounsbury) is published by request:—

Some time was given during December, chiefly by Assistant Thomsen and Plant Inspectors Hodgson and Delport, to an insect disease to which the descriptive names "caterpillar wilt" and "insect cholera" have been applied. This disease (or a disease or diseases of like character) causes extensive mortality amongst caterpillars of various species in this country in common with other countries, and is probably one of the most potent factors in the natural control of many insects. It may be that it is the influence which in the normal season prevents the wattle bagworm from becoming seriously abundant in certain areas, and which accounts for this pest being less prevalent in rainy than in dry seasons. The caterpillar victim becomes inactive, ceases to feed, and voids much dark-coloured, fœtid, liquid matter. The posterior part is meanwhile somewhat distended, and caterpillars which are normally smooth and green come to present a peculiar lustreless and sickly appearance. The victim soon turns dark, becomes flaccid, and the body contents, beginning from the posterior end, disintegrate into a black liquid of offensive odour. The skin stretches out with the weight of its contents, and many break at a slight touch. When attacked, the caterpillar usually seeks an elevated position, such as the top of an herbaceous plant, and at death remains clinging to its support by its anal or one or more of its abdominal prolegs. The dead body thus hangs limp from its middle or its posterior end. In a few days only a dry and blackened skin, or perhaps only a dark stain where it was attached, remains to mark the tragedy. Caterpillar disease of this general character has been ascribed by different writers in Europe and America to various organisms, and there is still much reason to question whether there is one principal disease or a number of diseases of different origin which produce somewhat similar effects on the victim. However this may be, I think the form of the disease which occurs in South Africa is unlikely to be excelled in virulence. Its work is most striking in lucerne fields, and for one on the lookout for such occurrences it is not an uncommon sight to see almost every stem crowned by a dead or dying larva of the lucerne colias (*C. electra*) or the heliothis (*H. obtectus*), two very common

and destructive lucerne insects. Larvae in all stages of the disease, clinging to lucerne stems, were included in the entomological exhibit placed on the Rosebank show three years ago, and a cutworm larva affected with the malady is figured on page 635 of Vol. XXXIII of the *Cape Agricultural Journal* (July-December, 1908). This figure is from a photograph taken by the present Cape Entomologist, Mr. C. W. Mally. Mr. Mally thought the disease bacterial in nature, and this is a commonly accepted view of its character. Ten or twelve years ago I tried to get the Cape Government Bacteriologist, Dr. G. W. Robertson, interested in the disease with the view of having economic use made of it. I have no notes preserved, but I recall that two distinct organisms were isolated from diseased caterpillars and attempts made to infect healthy caterpillars. The results were not encouraging, and owing to various difficulties the work was abandoned. Some years later, 1905, Mr. Mally made from diseased caterpillars of the lucerne colias artificial cultures of what he believed to be the proper organism, and used them, diluted with water, for spraying caterpillar-infested lucerne. He thought for a few days that he had succeeded in inducing an outbreak of the disease, but then he found the disease to be prevalent and sweeping off the caterpillars in lucerne fields wherever he went. He mentions the occurrence on the page of the *Cape Agricultural Journal* referred to above. He has since stated that it is his opinion, based on years of observation, that a close search will generally reveal the disease to be present in any lucerne field when caterpillars become abundant, but that it is only occasionally that the conditions are favourable to its development to the extent of its practically extirpating the caterpillars in a field.

The same disease, or one of similar character, is recognized as of importance in keeping down the numbers of the notorious nun moth of Europe, and in late years attempts have been made by certain European workers to induce outbreaks of this disease at will. It is now said that caterpillars will contract the malady which in Europe is called flacherie if they are fed on foliage that has been kept in water for a few days, and that if specimens which become infected in this simple way are put amongst healthy caterpillars out of doors the latter will contract the disease and perish. That caterpillars are likely to sicken and die if fed on water-soaked or even wet leaves is a matter of common knowledge to most people who have had much experience in rearing moths and butterflies from confined larvae, but so far as I know any connection of this trouble with the apparently infectious disease which at times appears wholesale amongst caterpillars in the field and forest was not suspected in the past. Published accounts of European work have led to field experiments with artificially induced disease in connection with gypsy moth suppression in America. These experiments have been conducted by an officer of the Bussey Institution of Harvard University working in conjunction with the Massachusetts State Forester, and the published results appear to support the claim that the disease does spread somewhat from care-infected specimens and can be utilized advantageously. The disease was generally started in the open by exposing the dead and dying caterpillars, together with all else from the cages, on strips of cloth about two feet long by one wide stretched between branches of trees on which caterpillars were present. It is

reported that the disease evidently affects many of the gypsy caterpillars without preventing them from completing the transformation to the moth stage. Egg clusters laid where the disease was established were found to average very much smaller and to contain a higher percentage of dead eggs than egg clusters in places known to have been free of the disease.

The work which I had done by Mr. Thomsen in the period covered by this report was instigated by the American trials. It began by the feeding of caterpillars on water-soaked foliage. Tests were made with the two lucerne caterpillars named above and with the pepper tree caterpillar (*Bombicomorpha bifascia*) common in the Transvaal. In all cases disease manifested by the characters above described appeared in a few days, sometimes within twenty-four hours. Sick and dying lucerne caterpillars and food these had fouled were then broken up into a bucket of water and sprinkled over caterpillar-infested lucerne in a field on the border of the town, but owing to cutting of the lucerne soon after, the results were indecisive. More material was then prepared and taken to lucerne lands at Godwan River about 190 miles from Pretoria, where, as the result of inquiries, I knew caterpillars to be giving trouble. Mr. Thomsen took this material down on 12th December, and, having broken it up into a bucket of water, he sprinkled it across and down a large field. At the time he failed to find any trace of the disease present in the field, and he thought he would be safe in assuming that any outbreak following on his visit would be due to infection introduced by him. Nine days later he visited the place to observe results, and then found the disease common over about fifty acres and it difficult to find any healthy caterpillars or chrysalides. I was absent in Capetown at the time, and, in accordance with a pre-arranged plan, a supply of sick and dying caterpillars was at once sent on to me in order that I might make a test in that part of the Union. Lucerne is not extensively cultivated in the Cape Peninsula, but there are quite a number of patches of an acre or less. I soon found one in Constantia that I thought would serve my purpose. A heavy wind prevented me from satisfying myself that the disease was not already present, but I found no trace of it in a search extending over several minutes. I had already discussed the question with Mr. Mally, and I agreed with him that it would be useless to make a test in any field where we could find the disease already at work. We visited the provisionally selected place together on the following day, and our close examination bore out Mr. Mally's expectations. Superficially, the field appeared free of the trouble, but a thorough search on hands and knees disclosed caterpillars in every stage of the disease. They were not confined to particular spots, but were scattered throughout the field. In parts where the lucerne had recently been cut and where the caterpillars were young, infected specimens were relatively rare, but where the plant was growing rankly and was ready for cutting, one or more typically sick caterpillars, generally about full grown, were to be found every few feet. We went to a field about three miles distant on another farm, and here also a small proportion of diseased larvae was found. Subsequently, I found the conditions practically identical at a third place. The natural deduction by Mr. Mally and myself from these and previous observations was that the outbreak of the disease at Godwan River was with very little doubt

quite independent of supposed virus that I had had placed there. In the south-western districts of the Cape the disease appears to occur with most virulence during the latter part of the summer, but in eastern districts, according to Mr. Mally, extensive outbreaks may occur at any time during the summer, a difference presumably ascribable to the climatic differences with respect to rains. My opinion that natural sources of infection were really responsible for what one might with apparent justice have claimed to be due to introduced contagion is strengthened by the fact that in the summer of the previous year the disease was rampant on the same farm. The owner had complained to the Division that serious damage was being done. I advised him to have the lucerne cut and asked him to have a lookout kept for the disease, which I told him might at any time appear and sweep off the pest. Some days later, 12th January, I was advised by telegram: "Sickness wiped caterpillars out." It is to be observed that the time of the outbreak was only about three weeks later than the date of the outbreak in the present season. The owner, a Johannesburg resident, however, gave full credit to the Division for this season's work. On 28th December he wrote:—

"I have just returned from Godwan River where I found the truly excellent results of your method of fighting the lucerne caterpillar. The fields had already been eaten very badly by the pest, and very large numbers must have been at work. There are very few of them left now, and they are mostly dying, while scarcely any chrysalides may be found. I congratulate you most heartily on your achievement, which means a great relief to all lucerne growers, and, at the same time, tender my sincere thanks to you and to Mr. Thomsen for the application to my fields, which I look upon now as being under absolute control."

I deal with this subject at length in this report with the idea of utilizing in the *Agricultural Journal* what I now write. Lucerne caterpillars are looked upon as a serious pest, especially in parts where it is customary to feed the crop down, and the wilt disease will probably soon be boomed as a sovereign remedy for them. Indeed, a paragraph on the subject, evidently inspired by some sensational account of oversea experiments, appeared some months ago in various newspapers, including the *Transvaal Chronicle*. It was stated that when caterpillars were troublesome in a garden, speedy relief was obtainable by collecting a number, feeding them for a few days on water-soaked lettuce, and then, when they sickened and began to die, turning them loose to infect the others. Under these circumstances it seems desirable to let farmers know that the wilt disease is a standing trouble amongst caterpillars, and that officers of the Division consider it doubtful that its efficiency can be economically increased by artificial cultures. Lack of time prevents my having more attention given to the subject this season than is indicated above, but I believe that some American investigators have lately paid considerable attention to it, and in a letter received last week the United States Entomologist informed me that a pronouncement in regard to its economic employment would soon be made by his Bureau. A farmer troubled with caterpillars on lucerne can easily experiment with the disease for himself, as it appears to be particularly easy to start with lucerne as the food plant. One has only to collect caterpillars and to feed them exclusively on lucerne that has been

soaked for a day in water. A whisky case, or any tight box of about that size, covered with thin cloth will do for a cage. Fresh food should be given twice a day, and, according to our experience, the disease will be rife in two or three days. Presumably, one should be able to start the disease in a lucerne field merely by grossly over-irrigating a part where caterpillars are abundant. It is only through the use of irrigation water when caterpillars are abundant that I think there is much prospect of the farmer being able to benefit by the disease over what he would in the ordinary course of events. By this I mean to suggest that the application of water may chance directly or indirectly to complete the combination of circumstances needful for the disease to do its most effective work. There is scope for investigation along this line and to ascertain under just what circumstances extensive outbreaks are likely to occur.

Export of Oranges.

By R. A. DAVIS, Government Horticulturist.

As it is impossible for the writer to call on every orange exporter in South Africa and personally explain the various details in connection with the above business, it has become necessary to address them through the medium of this publication.

As is now pretty generally known, the latest contract between the Government and the Union-Castle Steamship Company has resulted in the securing for the fruit growers of South Africa much more favourable rates of freight than previously existed. For instance, in the matter of citrus fruits, these were formerly carried in the ventilated hold of the steamers at a fixed rate of 25s. per ton. Next season's shipments will go forward in the vessels' cool chambers *at the same rate.*

This is a most important concession, as it is an established fact that the destructive "blue mold" which has at times caused such loss amongst citrus fruits, sent hitherto in ventilated hold, is comparatively harmless when oranges and other like fruits are kept at a low temperature.

Under these improved conditions, then, there should be a far less percentage of loss and a corresponding increase in the returns for fruit sold.

In order, however, to avail themselves of the advantage of shipment in the cool chambers, shippers must be prepared to submit their fruit for inspection and to pay a small charge for having it done.

Inspectors have been appointed by the Government at Capetown, Durban, and Port Elizabeth. The charge for inspection has been fixed at 1s. per ton of 40 cubic feet for all boxes going 25 and under

to the ton, and 1s. 6d. per ton for all smaller sizes. Five per cent. of the boxes in each consignment will be opened for inspection, and all boxes so opened will be stamped to that effect. The inspector has power to reject all fruit which does not comply with the regulations contained in the Government regulations, Notice No. 1546, a summary of which is as follows:—

The size of the box in which the fruit is packed for export must be—

(*a*) For pears, peaches, nectarines, apricots, plums, grapes, and melons (outside measurement).—18. in × 12 in., or 24 in. × 18 in., the depth being optional.

(*b*) For pineapples, cayenne variety, giant Kew (outside measurement).—27 in. × 16 in., depth optional.
Queen variety.—27 in. × 14 in., depth optional.

(*c*) For citrus fruit (outside measurement).—
Oranges.—26 in. × 12½ in. × 12½ in., or 13 in. × 12½ in. × 12½ in., or 26 in. × 12½ in., depth optional for single layer boxes only.
Naartjes.—18 in. × 12 in., depth optional; and for half-cases, 24 in. × 12 in. × 6 in.

(*d*) For mangoes (outside measurement).—18 in. × 12 in., depth optional.

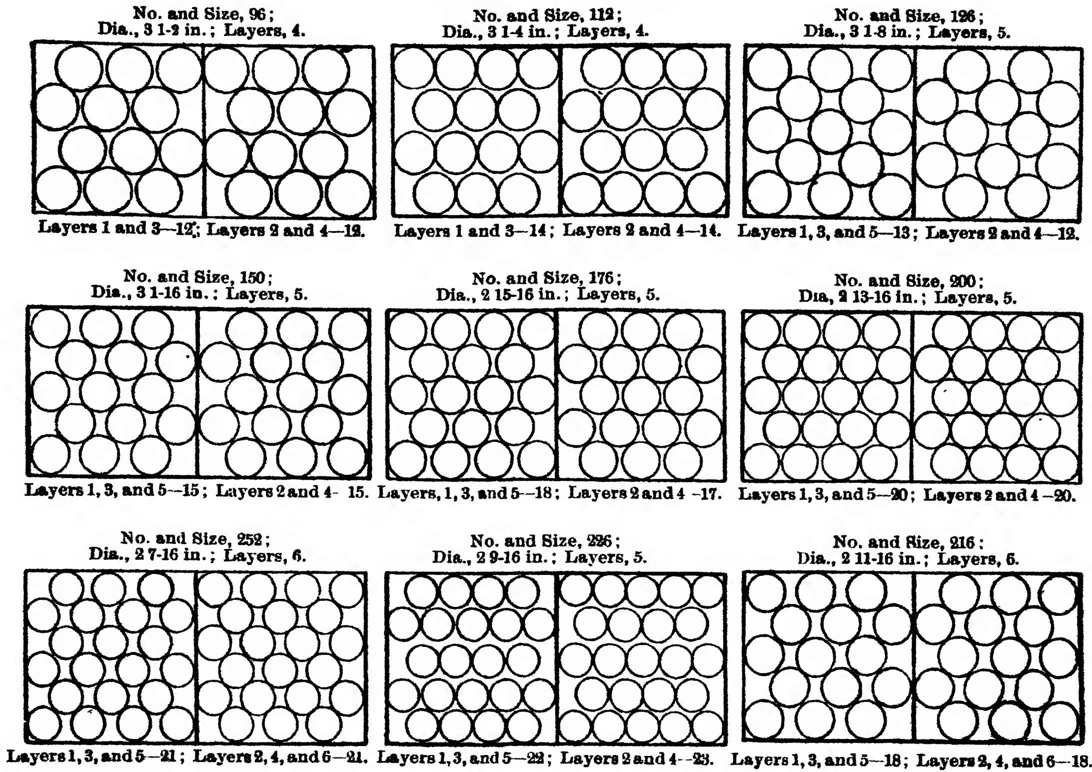
Grapes may, however, be shipped in crates, which are recommended to be a multiple as regards length and width of the size of the grape box mentioned under (*a*). Beginning with the season 1914, crates must be a multiple of the said grape box.

Every box of fruit submitted for inspection must be consigned to the Dock Goods Superintendent, Capetown; the Port Goods Manager, Port Elizabeth; or the Port Manager, Durban; direct, or to him through an agent, and bear on the top of the box the shipping mark of the agent appointed by the exporter to dispose of his fruit oversea. All fruit must be of first rate quality, free from blemishes affecting the appearance of the fruit, evenly graded, and uniform in size, and of the characteristic shape of its variety. Citrus and pine fruits will be accepted for inspection to within twenty-eight hours of the sailing of the vessel for which they are intended.

Subject to appeal to the Board of Reference mentioned in condition 16, the decision of the inspector as to whether any box of fruit should be passed by him or not shall be final. Any exporter or his agent who is dissatisfied with any decision of the inspector, in terms of condition 15, may appeal to the Board of Reference appointed at the respective port, namely: Messrs. Maynard Nash, T. L. Watermeyer, and A. A. Persse, in Capetown; Messrs. T. S. White, Hansen, and Westbrook, in Durban; and Messrs. J. W. Whitehead, R. Baldie, and C. H. Mackay, in Port Elizabeth. The decision of the Board on the question submitted to it shall be final.

Citrus Fruit. Oranges.—These must be packed in accordance with standard packs, the box of 26 in. × 12½ in. × 12½ in. (outside measurement) containing packs of 96, 112, 126, 150, 176, 200, 226, or 252 oranges. Half-boxes of 13 in. × 12½ in. × 12½ in. (outside measurement) will contain exactly half the above numbers. Single-layer boxes must be marked with the variety and number of their contents.

Export of Oranges.



SHOWING METHOD OF PACKING ORANGES.

Naartjes.—The minimum size naartje to be exported is $1\frac{1}{2}$ in. in diameter. Loose skin naartjes *will not be passed.*

These regulations are really safeguards framed in the interests of the careful shipper, designed to eliminate as far as possible the careless and to assist those who may err through ignorance.

The inspector will take notes of any mistakes in packing which he may see and write the individual or firm with regard to same, giving instructions as to how best to remedy the faults noticed. It is fully recognized that some of the more conservative will not perhaps wish to at once avail themselves of the new system, arguing that as their fruit previously went forward without inspection and realized fair prices the same should continue to be the case. For such, the same conditions are still available at the same price as before. No inspection of fruit carried in ventilated hold is necessary, but it is most earnestly desired that the boxes containing the fruit should be of the standard size—however even this is not compulsory; in fact, no compulsion exists in any shape or form.

The question is sometimes asked: "Why should boxes of standard size be used at all?" To this there are several replies. In the first place, taking for granted that all fruit fetches better prices when graded for size, it became necessary to select boxes of such dimensions as would *pack* the different grades of fruit best and with the greatest economy of room. It was soon recognized that the box in use as a "standard" in California, Florida, and Jamaica filled these conditions, and that is one reason for its adoption. Secondly, for economical and safe packing in railway trucks, uniformity of size is required. Thirdly, the steamship company, desirous of utilizing the cool chambers of their vessels to the fullest possible extent, found that this could only be done by the adoption of uniform or standard sizes; also that the measuring up of a consignment of boxes of various sorts and shapes was not only a tedious operation, but that it caused great loss of time. Last, but not least, the Trades Commissioner in London found it impossible to cable prices which would convey any intelligible meaning as to values realized for fruit. This, naturally, could not be otherwise when, as on some occasions, it actually happened that no fewer than fifteen different sized boxes arrived in one shipment.

The adoption therefore of a standard box became not only desirable, but an actual necessity; the addition of the half-box and single-layer box provides accommodation for every class of fruit, and will certainly be hailed with delight by the Trades Commissioner, whose cables in future as regards inspected citrus fruits will simply read: Standards, half-boxes, and single layers, and the prices of each.

TIME OF YEAR TO EXPORT.

Experience gained during the past few years goes to show that it is unwise to begin shipping too early in the season. It occasionally happens that a few early shipments fetch good prices; presumably these consist of small consignments only, therefore form no criterion as to what would happen if large quantities were sent. Hitherto, most shipments of South African oranges have gone to England, though some have been sent to the continent of Europe. It so happens that shipments made early in the season arrive in London just at

that period of the year when strawberries and other berry fruits are largely in evidence, and the consequence is that only a limited demand exists for oranges, and that at low figures.

As soon as the season for these fruits is past, there is room for our oranges at better prices. They should, therefore, arrive in England from about the middle of July. Last year's experience showed that prices were well maintained during August and September, and a few shipments in October fetched high prices.

It has been also pointed out that a really good sweet orange finds a remunerative market right up to Christmas. This makes the export of late kinds such as Du Roi and Valentia Late profitable and their more extended planting desirable.

WHAT TO EXPORT.

The orange which has fetched the highest prices consistently at the Covent Garden Market is the Washington navel. Packed in single-layer boxes tastefully gotten up, arriving in good order, as much as 6s. per dozen was realized last season for some extra fine specimens. Others, in similar packs, reached 3s. 6d. and 4s. 6d. per dozen. Packed in standard boxes, this fruit sells at from 15s. to 28s. per case.

Good seedling oranges have also fetched fair and reasonable, and occasionally, high prices. Each orange district naturally considers the fruit grown in that district the best, so it is useless to make any pronouncement as to what particular one sends the best fruit. In all cases, however, it has been found that a nice round smooth-skinned fruit, well coloured, is preferred to an oblong or egg-shaped, coarse-skinned article, so that when deciding on what fruit to export, the above facts should be borne in mind.

Besides the above, very few named varieties of oranges have been shipped. There is little doubt but that some of the kinds which are favourites in other countries would also be profitable for export from South Africa. Jaffa and St. Michaels are well liked on the English market, whilst export of the "Navelencia" would extend the season for navels for another month.

HOW TO GO ABOUT EXPORTING.

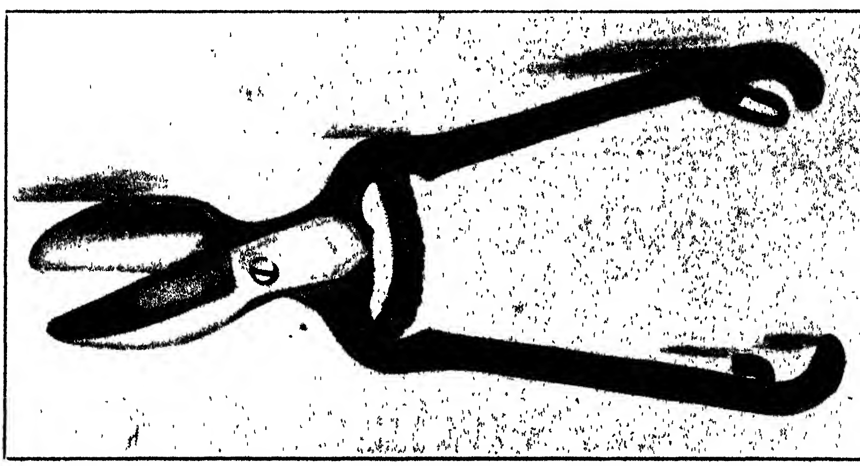
There are so many little details in connection with the actual handling of the orange for export which should be observed that it is proposed to set them all forth in hopes that *the careful shipper* at least will give them the attention they deserve.

PICKING THE FRUIT.

Picking is really not the right word, because in no case should an orange intended for export or, indeed, any marketable purpose, be removed from the tree by any other means than "cutting." In order to do this properly, and with the least possible chance of injuring the fruit in the operation, a special clipper is made for the purpose, as shown in the illustration. It will be noticed that the points of the blades are rounded so that the risk of pricking the fruit is reduced to a minimum. These clippers are now stocked in all our large towns, are easily obtained, and not expensive. The stem of the orange is first severed perhaps an inch or two away from the fruit; then a

second cut should be made removing the entire stem, with the exception of the extreme end by which it is attached to the orange. The removal of the stem close to the fruit is of much importance, because when it is left half to three-quarters of an inch long it is a constant menace to other fruits with which it may come in contact. The Trades Commissioner, in his reports, has frequently mentioned how much damage has been done to oranges in this manner, the stems left having punctured the skin of the adjacent fruit and thus afforded an opening for the *Penicillium digitatum* or blue mold.

Pickers should be made to understand that their *work* must be done carefully; their finger nails should be trimmed so that there may be no danger of even the slightest puncture of the skin from that source, or, better still, cotton gloves can be worn—these are cheap and easily obtainable. In this country where so much coloured labour is used, it is imperative that some responsible person should be placed



ORANGE CLIPPERS.

in charge of the picking gang, and it should be his duty to watch each man at his work and see that it is done as it should be. The fruit should be picked with the idea of giving as little work in sorting for blemishes afterwards as possible; to that end no fruit with any kind of a blemish should be picked for export. That which is picked should be ripe, but not over-ripe. It is quite useless to pick green oranges with the idea that they will "colour up" in transit; even if this were the case, which it is not, fruit picked in a green condition does not open up sweet at its journey's end. Pickers should carry bags, or such an appliance as is shown, in which to place the fruit when picked. In either case the receptacle is emptied by allowing the fruit to escape through the bottom, which is kept fastened whilst picking is going on. The oranges should be carefully emptied into "picking boxes" placed in the shade of the trees to receive them. These boxes, sometimes termed "lug" boxes, should form a part of the outfit on every orange grove. However, it often happens that they are absent, and when this is the case the boxes in which it is

intended to export the fruit may be used, care being taken not to fill them too full, as if this were done and the boxes piled one on the other, the fruit would get bruised. Before use, each box should be carefully turned upside down and tapped smartly with the hand to dislodge any particles of soil or gravel which may have got inside, and which, if left, would certainly cause punctures to the skins of the fruit.

It is important to remember that oranges for export should be picked dry. In the coastal districts especially is this necessary, where the air is heavily charged with atmospheric moisture. Under no circumstances should picking be done when there is dew or mist on the fruit. In the interior higher and drier portions of the country, picking may usually commence in the early morning and continue to night-fall, but in the coastal districts all work of this kind should approximately be done between the hours of 10 a.m. and 4 p.m.

The boxes of oranges should be hauled with care to the packing-house wherever that may be. The writer has seen many instances where fruit has been hauled to the pack-house loose in the bed of a wagon. Under circumstances such as these, *it is impossible to make orange export pay.* The necessary care *must* be taken, details attended to, and each operation *must* receive the attention it demands and must be properly done if South African oranges are to attain that position in the world's markets which they should.

CURING.

It has been customary in the past to allow the fruit to remain in the boxes for sometimes four or five days before sorting. The object of this was to allow of the escape of surplus moisture from the skins by evaporation, and thus to render them tougher and less liable to injury. For the last year or two, experiments have been made which tend to show that it is not necessary to cure the fruit for so long a time. Two to three days are recognized as ample, and there are instances of fruit being picked, packed, and shipped the same day which has arrived on the other side in perfect order. It is certainly better to under than over do the curing process.

SORTING.

As has been stated, the bulk of our oranges exported, so far, has consisted of two classes—Washington navels and seedlings. Naturally, the outside of the boxes is branded with the size and variety of the contents; thus there would appear to be but two classes of orange leaving our shores. Whilst this is really perfectly correct, each of these classes is capable of considerable sub-division. There are several types of navels and a very multitudinous assortment of seedlings. Efforts were made in the Transvaal in 1907 to classify these to some extent, and therefore the different grades were exported under the designations of "standard," "choice," and "fancy." It is by no means certain that this effort was a success, for it was found that "standards" oftentimes fetched more than "choice"; possibly the sorting was at fault.

It is the writer's opinion that the marking of the boxes with the names of the varieties they contain is sufficient for our needs at the present, and, perhaps, for some time to come.

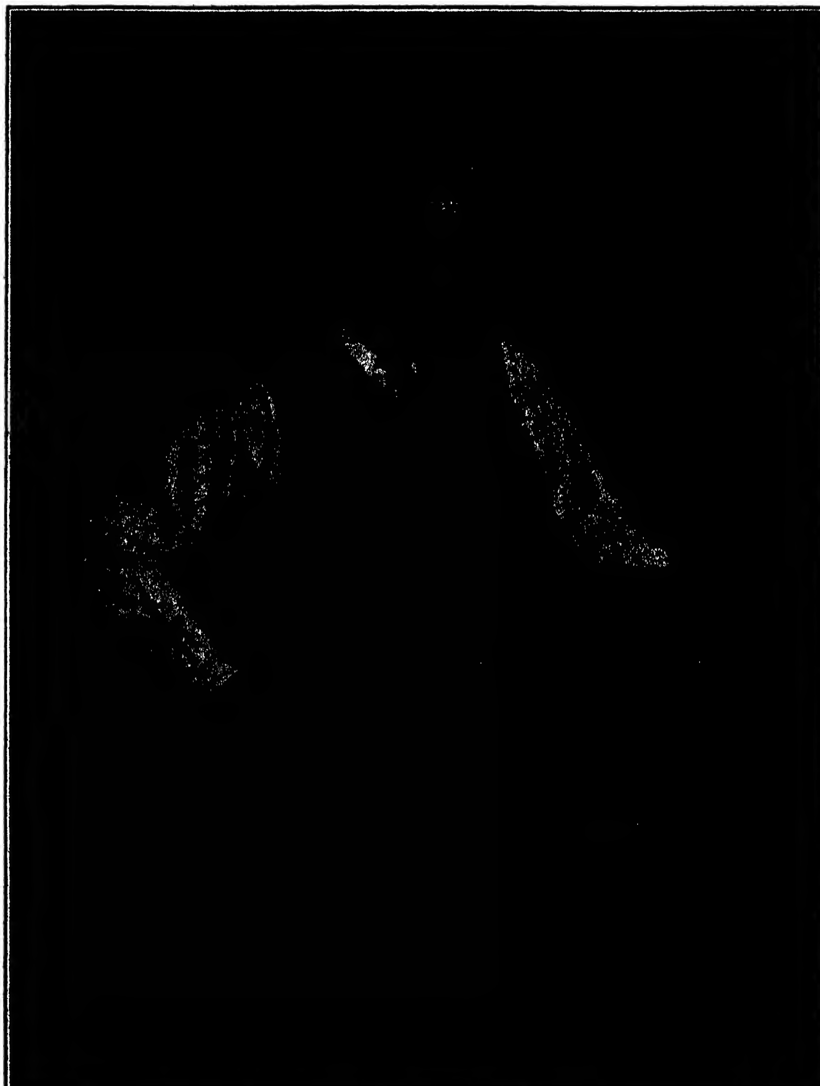


Plate No. XXXVIII.
THE "ARTON" PATENT ORANGE-PICKING BUCKET.

The tendency amongst buyers of citrus fruits is to purchase that which they see and prove to be good; therefore if good fruit only goes forward, the sorting for quality and varieties is but a secondary consideration. Sorting for the removal of blemished fruit, however, is another matter, and this should be done both as it passes through the sizing machine, commonly called a grader, and as it is wrapped prior to being placed in the boxes.

GRADING FOR SIZE.

This is one of the most important of all the details which go to make up a perfectly packed box of fruit. Unless oranges are perfectly graded for size they do not pack properly. On the other hand, when sizing has been carefully and well done, the packing of the standard box of oranges is simplicity itself. *It is not possible* to grade oranges perfectly by hand and eye. Recourse must, therefore, be had to some kind of a machine which will attend to the work in a manner mechanically perfect. There are a few of these on the market in South Africa now which perform the operation in a more or less satisfactory manner, and information can be obtained as to these on application to the Chief, Horticultural Division, Agricultural Department, Pretoria.

It is, however, quite possible for a farmer to make his own grader, and two methods are given, both simple and equally effective. First, a table with slats across instead of a solid top, very slightly inclined so as to enable the fruit to roll downwards. The width between the slats should correspond with the sizes given in the illustration as being correct for the different "packs"; the slats should be arranged with the smaller spaces at one end of the table and the larger ones at the other. As the fruit passes over them it falls through according to size. The slats must be planed quite smooth and no rough edges left on; the corners should be slightly rounded. Allow three spaces for each size, and, underneath, at a distance of about four or five inches, canvas troughs must be placed into which the fruit falls; these must also be slightly inclined so that the fruit may roll into boxes placed to receive it, and these boxes must be so arranged as to prevent any bruising of the fruit—this is easily done by placing plenty of wood-wool in the bottom of the box or fixing a piece of canvas to break the fall of the orange. Tables of this kind may be made to sort the nine sizes of fruit, from 96 to 250; they should measure from 10 feet to 12 feet in length, and may be 4 feet wide.

The second size is also a table, only this time with a solid wooden top planed to a perfect smoothness. It also is slightly tilted at one corner only, allowing fruit placed on it to run downwards with a slight sideward motion. Across this table are placed a series of round wooden bridges or rollers also planed and sand-papered perfectly smooth. That at the upper end of the table is distant 3½ inches from the bed of the table; all oranges passing under that bridge must, of necessity, be less than 3½ inches in diameter. At a slight interval, say, about a foot, the next bridge is placed in accordance with the next smaller sized fruit, i.e. 3¼ inches. As the end of the table is reached the bridges are placed to size the fruit for each particular grade required. The oranges run to the lower side of the table and

into receptacles provided for them, each size being kept separate. In using this kind of table they need not be allowed to drop an inch.

Either of these simple devices will do satisfactory work provided proper care is taken in handling the fruit.

Wrapping the Fruit.—For this purpose a thin tough tissue paper should be used of size convenient for the fruit which it is desired to wrap. As a guide to purchasers, the following table is given:—

For standard box,	96 pack	12 in. × 12 in.
,,	112, 126, 150... ...	10 in. × 12 in.
,,	176, 200	10 in. × 10 in.
,,	216, 226, 252... ...	9 in. × 9 in.

The fruit should be perfectly wrapped, i.e. each orange completely surrounded with paper, which should be finished off with a twist, and, at the same time, be so placed round the fruit as to display the "brand" to the best advantage. All wrappers should bear the same distinctive mark as that which appears on the outside of the boxes containing the fruit. A neatly gotten up brand renders the appearance of the fruit more attractive.

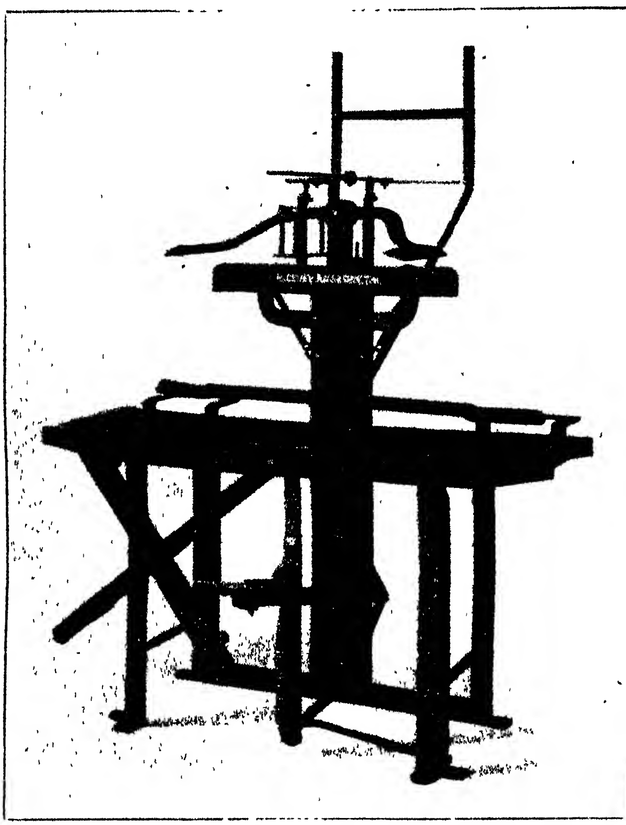
Girls and women handle, wrap, and pack oranges far better than youths and men. Their fingers are more supple and quick, and an inexperienced girl will become quite deft at the work in a few hours. Work in connection with packing oranges is clean, light, and pleasant, and should also be well paid in order to secure reliable and competent workers. When this is the case it often happens that one obtains the same packers year after year; in fact, the orange packing season is looked forward to as a means of earning a few pounds for the purchase of some item perhaps otherwise unobtainable.

Packing.—With oranges correctly graded for size, packing in the export box is very simple and easy. In the standard packs shown in the diagram there is a place for every orange, always provided that the packing is done as it should be—neatly and firmly. A well packed box of oranges on arrival at its oversea destination should open up with a neat, attractive appearance; this can be secured by adopting the "packs" shown, and cannot be obtained should the fruit be placed loosely in the box.

Loose packing is not only the abomination of the fruit dealer, but it is far from economical. Three boxes of tightly packed fruit will hold as much as four packed loosely. A loss on the latter is thus evident in the cost of the extra box, as when fruit is shipped oversea, freight is charged by the ton of 40 cubic feet. It must also be plain that a further loss of 25 per cent. occurs in extra freight charges. Wrapping and packing the fruit should be done by the same individual and form one operation. It can only be properly done when standing up. The erect position gives a command over the work not obtainable when one sits down to it; therefore there should be no chairs in the packing-house. It will be found in nearly all the different "packs" shown that the fruit will rather more than fill up the boxes; in some instances it will stand half an inch above the sides of the box. This necessitates further careful handling in the nailing up, and ensures that tightness which is indispensable for the safety of all fruits of no matter what kind when in transit.

In the up-to-date packing-houses of California a press is used (as shown) which forces the ends of the cover down, so that the boxes

are easily nailed up. If a press is used judgment is essential, as a quick harsh movement is liable to cause the paper on those oranges next the sides of the box to be rubbed off. A gradual pressure is therefore needed. As there are very few presses in use in South Africa, it may be as well to say that the next best way to nail up a box is to fasten the one end down first, driving the nails through cleat and cover; then bend the other end of the cover over and attend to that.



THE MODERN FRUIT BOX PRESS.—New Model.

Over cleat and cover, at each end of the box, a thin iron strapping should be nailed to ensure the stability of the box during its 6000-mile journey. A flat plaited grass is also largely used for this purpose in Europe, and is being tried here this season.

Nailing up of boxes is a white man's work, as it needs to be done quickly, carefully, and well. The Trades Commissioner in some of his last year's reports from London, remarks on the weakness some people in South Africa have for driving nails into the oranges and not into their right places in the box. This is one more of the details which need care and which should only be placed in the hands of reliable workers.

Marking the Box.—This should be done in accordance with the requirements of the regulations. Each box should be marked on the end with the variety and the exact number of fruits contained in the box, and the top of the box should bear the shipping mark of the agent appointed to dispose of the fruit oversea. All boxes full of oranges should at all times stand on end; ventilation is in this way assured and the liability to heat which occurs when they are placed one on the other on their sides is obviated. This applies to the cases when they are stacked in the packing-house awaiting shipment, in the railway truck en route for the coast, and in the cool chamber or hold of the steamer, as the case may be.

This arrangement further admits of the instant identification of all boxes on arrival at their destination by the oversea agents.

CONCLUSIONS.

1. From observations and reports of the Trades Commissioner in London it is certain that South African grown oranges compare favourably with the best products of any portion of the world.

2. In order to avail ourselves of the market which exists in the Northern Hemisphere for our citrus fruits during the period when no others are available there, our oranges, etc., must be sent away so as to arrive in the best possible condition.

3. This can only be done by the exercise of the utmost care in handling the fruit from the time of gathering to placing the boxes on the market; therefore no one should attempt the export of oranges who is not prepared to take pains to do the work properly.

CORRECTION.

In the notice which appeared in the December *Journal* it is stated in the third paragraph on page 899, under "Standard Orange Boxes," that the Government fruit inspectors at the ports will not pass any but boxes made in accordance with the sizes quoted in the regulations, so that should any odd sizes be offered for shipment they can only go forward in the *ordinary* hold. In place of "ordinary" the word *ventilated* should be used.

Rural Notes.

Capetown Scab Conference.

An important conference was held in Capetown on the 4th-7th February, 1913, when the Senior Sheep Inspectors were called together to discuss the arrangements to be made for the carrying out of the compulsory dipping of sheep and goats throughout the Union, and to consider certain amendments proposed to be made to the Scab Regulations. The opening meeting was (by courtesy of the Capetown Chamber of Commerce) held in the old Town Hall, Greenmarket Square, when there were present: General the Right Hon. Louis Botha (Minister of Agriculture), Mr. F. B. Smith (Secretary for Agriculture), Mr. B. Enslin (Chief of the Sheep Division), Mr. A. G. Davison (Principal Sheep Inspector), and all the Senior Sheep Inspectors. General Botha said it was a great pleasure to him to meet the inspectors. He was glad that an opportunity had occurred for them to meet one another, for, so far as the eradication of scab was concerned, more rested on their shoulders than on anybody else, and if anything went wrong they would get the blame. For this reason he was glad they had come together to discuss matters and to decide what was best to be done to carry out their duties in a proper manner. He recognized that the difficulties which the inspectors had to face were great, and he feared the men concerned did not know each other so well as they should. Now that a chance had occurred, he hoped they would get to know one another better, and that their deliberations would result in greater uniformity in carrying out their work. At present one inspector worked one way and another dealt with matters on different lines. It was only by co-operation that they could hope to get uniformity, and by co-operation they would get better results.

The Minister said that they were there to discuss the new regulations, and he hoped they would assist the Government to make these as sound as possible. He knew their task was a very unpleasant one, but they must remember that every one with responsibility had unpleasant work to do at times. He appreciated their difficulties, and because he appreciated those difficulties he had come to say a few words to them. If, in carrying out their duties, they did what they ought to do, they could always rely upon the Ministers' support through thick and thin. General Botha said he was the head of the Department to whom they all looked for protection when they were attacked, and he could assure them they would not need to ask for protection if they did their duty, for it would always be at their service. It was necessary to eradicate scab. If there was any way in which matters could be put on a better footing, General Botha hoped it would be pointed out. He desired the inspectors to use persuasion rather than force, because by that means they would be more likely to achieve the end in view. They should endeavour to get the farmers to dip their sheep under the supervision of the inspector, for sometimes a farmer used weaker dip than he ought to do. Farmers had told him that as long as the sheep had been through

the tank it was "all right"; dipping with too weak a dip might not kill a single parasite. It was necessary for the farmers to be taught that the scab parasite had a father and mother, just as they (the inspectors) had, and then to teach them that the parasite was a creature which must be killed. The Minister went on to say that he hoped the conference would assist in making the regulations as strong as possible, provided they made them practicable. When discussing simultaneous dipping they were to remember that there were portions of the land where little or no rain fell. There were portions where, in certain seasons, simultaneous dipping could not be carried out. The inspectors would not improve matters by compelling a man in such a place to dip his flock; they would make an enemy of a man who at present is in favour of the scab law—an enemy to it, if they insisted on his dipping his sheep under such conditions. The condition of the sheep must be considered.

General Botha went on to say that they were to frame regulations which would prevent the movement of infected sheep. If scab broke out on a farm they were to make the farmer stay there, no matter what the condition of his flocks, but such a man should not be compelled to dip when dipping could only be carried out with a heavy loss. Where the conditions are such that dipping can be carried out safely, the inspectors should see that the stock were dipped. Simultaneous dipping was a difficult matter. There were so many different conditions in the various parts of the Union. Farmers from Swellendam had told him that March was lambing-time. That difficulty was so great that the Minister could not say how best to deal with it, for there was a class of farmer whose sheep lambed from March to March. Scab was such a serious matter that they must progress; they could not go back; they must press forward or they could not justify the money spent when Parliament asked what had been done with it. What was required was that everybody should support the work; they must not make a political matter of scab, nor must they look forward to a hundred years of scab eradication. They had got to go forward a little each year and then they could rely on the support of Parliament. The Minister said they were to proceed carefully; he had mentioned several of their difficulties. They were not there to bring other difficulties into being, but rather to deal with those they had. Perhaps their greatest difficulty was to get good scab inspectors. It was stated that some of the inspectors were not of the desired class—men who had failed as farmers and had turned to sheep inspection as a last resort, and, naturally, the sheep farmers would have no faith in such men. They must attempt to get the best possible class of man as sheep inspectors. They received hundreds of applications for appointment, but he would remind them that President Kruger had said: "Give me the man who has not made application—that is the man I want." That was the man they all wanted, and what he (the Minister) wanted them all to do was to inquire very carefully to see whether they could not get a better class of inspector who would give the Government better work and the farmers more satisfaction.

Complaints, General Botha went on, would occasionally come in against one or other of the sub-inspectors, and it was then the duty

of the senior inspectors to inquire into them very carefully. They must always inquire very carefully into the faults of their subordinates. In conclusion, the Minister hoped they would use discretion and help to put the regulations right, so that scab could be eradicated. If they did this, the country would owe them a great debt of gratitude. Mr. Davison thanked the Minister in a few suitable words for his attendance at the conference, and for the encouragement which he had given to the Senior Inspectors, after which the Minister and Secretary for Agriculture left the meeting. Mr. Enslin expressed regret that, for one reason or another, it had not been possible to give the Senior Inspectors longer notice of the intention to hold the conference, but was glad to find that they had all managed to attend. They had before them the draft revised regulations, and he invited the fullest discussion on them and on the arrangements to be made for simultaneous dipping. The conference then proceeded with its deliberations.

Government Purchases of Stock.

The Department of Agriculture has lately been making considerable purchases of pedigree stock for its experimental and stock farms. There was recently landed from Australia a valuable consignment of Merino sheep costing about £5000, purchased by Mr. J. McNab, chiefly for the establishment of stud flocks of Merino sheep at the Grootfontein School of Agriculture. A large consignment of horses has also been landed, chiefly stallions, which, at a later date, will be leased to farmers in the different Provinces. This consignment cost about £6000, and consists of horses of the following breeds: Thoroughbred, Hackney, Oldenburg, Clydesdale, and Percheron. These purchases were entrusted to Mr. J. J. Martin, manager of the Tweespruit farm, and the same officer is now engaged in purchasing a number of Shorthorns and Ayrshires, and Large Black and Berkshire pigs in England and Scotland. This consignment of cattle and pigs will cost in the neighbourhood of £5000. Mr. J. J. Enschede and Mr. H. Wibbens have been entrusted with the purchasing of about forty head of Fries cattle in Holland, and these cattle are destined for the Grootfontein and Cedara farms and schools of agriculture. It will thus be seen that, within the last few months, the Department has spent or is spending the sum of about £16,000 in the purchase of valuable pedigree stock.

Pear Leaf Scorch.

The Chief of the Division of Entomology (Mr. C. P. Lounsbury) writes:—For a number of years a leaf scorch of pear trees has been a source of some anxiety to many fruit growers in the Western Province, and in the present season more complaint than usual is being made. Some trees are only very slightly affected, while others lose so much of their foliage that they must suffer considerably. Affected leaves retain their form, but turn brown from the side or end, and dry out in whole or in part. A single branch may bear normal leaves with leaves affected in varying degree, and the trouble, while perhaps generally most in evidence on sheltered parts, may occur all about the tree. The general appearance would suggest the scorching

of the foliage by hot winds were it not that as many leaves on the lee side as on the windward side may be affected. Most, if not all, varieties appear subject to the trouble, but certain varieties suffer far more severely than others, and amongst these Souvenir du Congress is the most affected. Beurre Bosc and Beurre Diel are also very much troubled. The cause of the scorching is in doubt, but it seems most probable that it is spraying with arsenical preparations primarily, and that the trouble is more or less severe is dependent upon other conditions. Pears are known to vary greatly in their sensitiveness to injury through arsenical sprays. The writer clearly recalls the case of a tree which was Beurre Hardy on one side and a kind of Bergamot on the other being sprayed with arsenite of lime. The foliage of one variety was very badly scorched, while that of the other was injured only slightly.

The arsenical used in the Western Province for fruit tree spraying is almost exclusively arsenate of lead. It is an erroneous belief that arsenate of lead is non-injurious to vegetation, and some brands are undoubtedly more liable to do damage than others. In fact, two different types of arsenate of lead, one known to be more likely to injure than the other, are put out by manufacturers, but the greater safety as regards scorching the trees on the part of the one is offset to some extent by other considerations, and it does not follow that it is always better to use the safer article. Spraying with arsenicals could safely be accepted as the cause of the scorch now under consideration if it were shown to be the general experience that unsprayed trees do not suffer, but spraying is so commonly practised against codling-moth on bearing trees and pear slug on young trees that it is not easy to find unsprayed trees of the varieties most troubled in that part of the country. It is desirable that the doubt be cleared up, and Western Province pear growers are solicited to inform the Department of their personal experience. It is requested that the following questions be answered, and that replies be addressed (O.H.M.S.) to the Cape Entomologist, Department of Agriculture, Capetown:—

1. What varieties have been observed to scorch, and what ones most severely?
2. What arsenical is used, naming the brand?
3. What is the source of the water used in spraying?
4. Is the scorch worse in years when water is abundant than when it is scarce?
5. What is the experience with unsprayed trees?

Answers to questions Nos. 3 and 4 are desired because American experiments have shown that the presence of a slight amount of brak (alkali), particularly of common salt, in the spraying water has a very pronounced influence on the amount of injury to foliage done by arsenate of lead.

Tuberculosis of Food Animals.

Mr. Walter Jowett, M.R.C.V.S., Government Veterinary Surgeon, Capetown, writes:—The following note was omitted from the paragraph dealing with tuberculosis in swine in the article on

"Tuberculosis of Food Animals" which was published in the January and February numbers of the *Journal*: With regard to tuberculosis of swine, whilst in South Africa as elsewhere many cases of porcine tuberculosis are undoubtedly met with in which the disease is generalized, yet, on the other hand, cases of tuberculosis are by no means rarely encountered in these animals in which the disease is merely localized in one or other of the cervical lymphatic glands (i.e. the lymphatic glands of the head and neck) or in the mesenteric or other glands in connection with the digestive tract. The question has been raised whether the carcasses of tuberculous swine in which the disease is strictly localized should not be dealt with on lines similar to those which are applied to cattle. This, however, is a question more directly concerning the expert meat inspector; in this place it is sufficient to note that swine are particularly prone to develop the disease in generalized form, and until a better system of meat inspection is in force in this country, it is decidedly wiser to adopt the recommendations of the Royal Commission on Tuberculosis with regard to the judgment and disposal of tuberculous swine, such recommendation reading as follows: "In view of the greater tendency to generalization of tuberculosis in the pig, we consider that the presence of tubercular deposit in any degree should involve seizure of the whole carcass and of the organs."

The Narra Fruit.

A year ago we published an interesting article by Mr. H. von Gerrard, the then magistrate at Walfish Bay, on the Narra fruit, an important article of food which is used by the Hottentots of the Walfish Bay Territory. Numerous inquiries from people interested in the Narra plant have since been received by the State Institute of Botany in Hamburg, and Dr. Cl. Grimme, of that institute, has recently contributed to a German paper published at Swakopmund an interesting note on the subject. He observes that the Narra (*Acanthosicyus horrida* Welw.) belongs to the family of the Cucurbitaceae. Externally, however, there is a great difference between this plant and others of the gourd kind. The Narra has no leaves, and covers in thick high hedges the sides and summits of the dunes in the territory of Walfish Bay. The green tendrils are thickly interlaced, and bear at short intervals very sharp thorns arranged in pairs which serve as an excellent protection against browsing animals. These thorns are transformed twigs and they stand below the leaves. The root is as thick as one's arm and often 15 metres long, and goes right down below the dunes into the damp ground. It has a wonderfully rapid growth and so withstands the wind, which can thus never cover up a Narra plant with sand. The blossoms have five petals and are remarkable for their regularity, for which alone they stand apart from the other Cucurbitaceae. The Narra blooms chiefly in October, and some of the fruit ripens about Christmas and lasts until May. The fruit is larger than a croquet ball and weighs very often over 3 lb. When it is ripe, like the orange, it can easily be divided into ten sections, which contain a great many seeds.

The unripe fruit is very bitter, but the cream-coloured ripe fruit with its sweet-sour taste is so good that even carnivorous animals,

such as the jackal, like to devour them. The sweetness of the Narra is of great value. On account of the high percentage of sugar it is remarkably nutritious, and is, therefore, the chief article of food in the diet of the native. The Hottentot is naturally lazy, and only works when hunger compels him to do so. As the Narras last the whole year and the sea contributes enough fish, at least half the natives do not work. The Narra field stretches eastwards as far as Hudaub, 150,000 metres inland, and most of it is German territory. The real Narra time lasts about five months. The natives then scatter over the field, so far as the exigencies of the water supply permit. Young and old, with all their goods and chattels, go into the fields, and, armed with long sticks, tap each fruit with a view to ascertaining how ripe it is. What they need for their daily food they eat where they find it. When more Narras are ripe than they can eat, the remainder are boiled without the outer peel. When the mush is brownish it is poured through a small basket (nowadays a perforated paraffin or other tin) on to the white sand and here it is left to dry in the hot sun, where it forms a flat leathery substance which is rolled up and put away for winter. The taste is not bad, but it is an "acquired" one. The seeds, dried separately, are sold as "butter-pits" to Cape merchants; the Cape natives like these pips and they eat them as we do nuts (the taste of which they resemble), or use them in making cakes or sweets as we do almonds. The Walfish Bay native grinds the Narra seeds between two stones (without separating the shell) and boils the meal thus obtained. This makes a most nutritious thick soup.

"Codling" or "Codlin"?

A Frankfort correspondent raises the question of the correct spelling of the word "codling" or "codlin." "In a perfectly friendly spirit," he writes, "I would suggest that the word is *codlin* as relating to apples, and not *codling* as relating to fish." The matter was referred to the Division of Entomology, and Mr. Claude Fuller, Entomologist, replies as follows:—It is admitted that the spelling "codlin" has the sanction of good usage insomuch that up to a decade ago it was so spelled by most English and Australian horticulturists and a few English entomologists, including the much-lamented Eleanor Ormerod, who always used the term. Nowadays, there are but few entomologists who would have the temerity to spell the word without the final "g." The etymology of the word can be approached from two standpoints. In the first place it is made up of "cod" and the diminutive suffix "ling"; to drop the "g" and make a new word simply for the sake of brevity in writing, not in speaking, "is an inexcusable violation of etymological rules," as the late Professor M. V. Slingerland has pointed out. The word "codling" as it stands is of modern application to certain varieties of apples having the peculiar codling shape. But, as a descriptive term for certain apples, it is of quite ancient origin. There can be little doubt that, before the shape of the apple determined its application, it was a corruption of the old English word "quedlyng." This term, in the fifteenth century, described any immature or half-grown apple, and two hundred years later was applied to a variety of apples suitable for cooking whilst still unripe.

It is therefore seen that for many a long day there has been a "quedlyng" or "codling" apple, and, applicable as this fishy word may now be to certain apples because of their shape, it does not necessarily follow that it originated in the shape of these particular apples. However, whether as a descendant of the ancestral term or not, it is correctly spelled "codling." In the compound word, "codling-moth," the hyphen should not be omitted according to the most reliable authorities. "Codling-moth," as of correct form and spelling, holds good all through. Above all, it is sanctioned by precedent, for it was first given to the insect by Mr. Wilkes in the year 1747, and he gave it that name because he found the insect infesting the fruit of the "codling-tree." In short, it may be said that the word "codlin" has as much right to a place in literature as that atrocious barbarism "coddling" which certain would-be etymological entomologists and horticulturists have endeavoured to foist into it.

Miscellaneous Notes.

Messrs. Karamalees Bros., 7 Pritchard Street, Johannesburg, have written to the Secretary for Agriculture asking to be furnished with the names and addresses of large growers of pea-nuts. Farmers interested might communicate direct with Messrs. Karamalees Bros.

The Visconde de Pedralva and Senor Moraes, Director of Agriculture and Principal Veterinary Surgeon, respectively, of the Portuguese West African Government at Angola, are at present on a visit to the Union. Part of the time of these gentlemen will be occupied in visiting some of the Government agricultural institutions, as they are anxious to see something of the work carried out by the Government at these stations.

Mr. J. Wentworth-Sykes writes to the Government Botanist:—"It will give you pleasure to learn that I have sold more than 16,000 lb. of teff seed this season to all parts of South Africa, and to Australia, New Zealand, and Canada, including British Columbia. This from the 1 lb. of seed you kindly sent me in 1905. I have never been without it, and do not intend to be so long as I farm on the high veld."

In his monthly report for December, Mr. E. J. Macmillan, then Agronomist at Bloemfontein, reports that the wheat harvest in the Free State showed a very poor return. "At least 75 per cent. of the crop was an entire failure. Oat-hay was little better than wheat; probably 20 per cent. of a fair average yield was obtained. Other cereals were not produced in any appreciable quantities. Lucerne lands have been used largely for pasturage owing to scanty veld, and little or no hay has yet been secured. The losses in stock have ceased. Sheep have generally maintained their condition well. The wool clip is heavy and the prices better than during last year."

Correspondence.

This section will be set aside for correspondence on all subjects affecting the Farming Industries of the Union of South Africa and cognate matters; and, while every reasonable latitude will be allowed, contributors are requested to be as concise and succinct as possible in the expression of their views.

Suggestions for practical consideration and discussion, and hints as to improved methods applicable to any branch of agriculture will be particularly welcome.

It must at all times be distinctly understood that the Department of Agriculture is in no sense responsible for the views and opinions expressed in this section.

All communications should be clearly addressed "The Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria," and written on one side of the paper only.

CLOSER SETTLEMENT.

To the Editor of the *Agricultural Journal*.

SIR,—I should like to take advantage of the opportunity you have given to readers of the *South African Agricultural Journal* to reply to Mr. J. J. de Villiers' very interesting letter on "Closer Settlement and Small Holdings" in your issue for this month.

I was all the more interested in it owing to the fact that it was to that district that I came nearly twenty years ago to learn to blend agricultural and horticultural knowledge gained in England with South African ideas and methods under a man who had learned to blend the ideas and methods of three countries with those of South Africa. I may perhaps mention here that my particular interest in closer settlement goes back for many years (to be exact, to the early part of 1902, when I applied to the Milner Land Settlement Department at Bloemfontein for a holding, in which application I was unsuccessful as I had not sufficient capital), during which I have travelled extensively cross country, principally in the Cape Province, and have noted conditions and farming methods and the possibility of small holdings in many districts. I have also had opportunities of studying existing closer settlements, amongst which I may mention Van Wyk's Vlei, at which I lived for several months, and Kakamas, which I have visited several times. I am also well acquainted with the closely settled parts of the Orange River east of Kakamas, and the more I have travelled and seen of the glorious possibilities of our country the more I have become convinced that sooner or later the Government will have to take this question in hand and work it for all it is worth as a non-party matter.

But to get back to Mr. De Villiers' letter. If the success of closer settlement and small holdings in the Caledon District were really as problematical as he seems to think, then the outlook in South Africa would be black indeed, for there are so many points in its favour in that district in both soil and climate that, in my opinion, it has advantages over almost every other district outside of what are known as the wine districts (through which I have travelled or lived), and that, if it were to fail there, it is hopeless everywhere else, but fortunately such is not the case.

Before enumerating some of these natural advantages for closer settlement in that district I should like to offer a solution of the problems put forward by Mr. De Villiers, i.e. (*a*) the most practical and speedy method of turning the surplus straw into suitable manure, and (*b*) the maintaining of the lands in a profit-yielding state.

In answer to the first I should like to say, for the benefit of those who do not know the methods of working in that district, that nearly all the farm traction is done by mules and that they are usually housed in a long stable, standing side by side with no partition, and that the droppings of these animals remain in the stable until, instead of hardly being able to get their heads into the manger as is often the case when the stable is cleaned out, the mules have to lower their heads considerably to reach their food. I have frequently

seen it quite two feet six deep. Now, apart from the harm that such a bed must do to the animals' feet and the unhealthy atmosphere in which they have to spend the long nights, and, further, the probable deteriorating effect this may have on the manure, if these stables were properly cleaned out daily and the floor well bedded with straw every night there would be none left to burn when harvest times comes round, and I think it would be a revelation to Mr. De Villiers the difference that would result both in quantity and quality of the manure heap.

Then as to point (*b*). Nearly all farmers in those districts have large Cape poplar and other deciduous tree plantations, and old sheep-kraal sites, some of which have several feet thickness of manure in them, and the application of the good depth of leaf mould that will be found under the trees, together with such sheep-kraal manure as there may be and some of the extra stable manure that will result from the treatment suggested above, and, further, a more frequent cleaning out of dams than is the custom, which yield a lot of good rich mud and which can be deposited straight on the land, will go very far to prevent any great deterioration of soil value; and I am equally confident that a little more attention to crop rotation, with an occasional cow-pea or similar crop ploughed in green, will do the rest.

I will now try to show some of the advantages of the Caledon and surrounding districts over other parts of the Union, and especially the high veld.

First and foremost it has a distinct advantage in that in few other districts can hillsides and the flat tops of kopjes be cultivated as they can there. I have often heard high veld farmers, after their first visit to the Cape, when the wheat is in the green, express great surprise at seeing wheat growing on top of the bult instead of only in the hollows. Then small holders will have an advantage in those districts in being able to get a certain amount of what is practically skilled labour. The farm labourers there, especially those who have never been out of their districts, do a day's work that would make three Transvaal Kaffirs feel sick.

If any one doubts this, let them do, as I have done, several weeks' work with a gang of them in a four feet six trench in a fairly stiff sandy loam, or reap day after day under the hot November and December sun in a gang with sickles on a hillside where the reaping machine cannot work, and their doubts will vanish far more quickly than their backaches, yet to them it is just an ordinary day's work and it goes on from sunrise to sunset. It is not done on mealie-pap, though.

Then nearly every holding would have a good supply of wood of some kind or another on it. Any grass-veld farmer can tell what a benefit that would be.

There are very few, if any, of the ruinous hailstorms that take the heart out of fruit growers in other parts of the country.

Many of the broader plateaus so common in those districts about a third of the height up the mountains, especially those with the deepest soils, will eventually prove to be valuable for fruit farming.

There a small holder could go in for a greater variety in the way of both stock and other produce without having such a variety of vicious pests to fight as I have seen in other parts. I do not mean to infer by this that those districts have no drawbacks, they have, but on the whole I think they are more easily overcome there than they are in many other places

I am also of opinion that the district of Caledon is particularly adapted to the French system of gardening, particularly as regards very early production under cloches, and generally more attention might, with profit, be paid to higher horticulture.

I should like to take this opportunity, Sir, as a land settlement enthusiast, of thanking you for your evidence before the Select Committee of the Senate on Land Settlement and also for all you have written since. Your recommendation to give a settler an advance in kind to the extent of £500 would have enabled many a man who has had a good sound training in farming, but who has no capital, to get on the land; and of such there are many.

The Land Settlement Act, as I stated some time ago in a letter which was kindly published by the *Transvaal Leader*, provides land for settlers who have a certain amount of capital, and also gives them a further certain amount of capital in the shape of assistance up to 50 per cent. of what they have spent for their own benefit.

Trusting your efforts in this direction will meet with the success they deserve,—Yours, etc.,

SETTLER.

CONVEYANCE OF POULTRY BY RAIL.

To the Editor of the *Agricultural Journal*.

SIR,—Crates of poultry sent to the various markets within the Union, as a general rule, do not comply with the railway regulations in regard to the size of the crate, number of fowls in each crate, and the drinking vessels. The Port Elizabeth Society for the Prevention of Cruelty to Animals is taking strong measures, and similar societies in other centres are doing likewise. I am assured that farmers are infringing the cruelty to animal laws in this respect unknowingly. To avoid trouble, expense, and heartburning in the future, it would be a wise plan to carefully read over the railway regulations in regard to conveyance of poultry by rail and profit by it. Such regulations are in the possession of every station master.—Yours, etc.,

F. W. FITZSIMONS,
Hon. Sec., Port Elizabeth and District
Society for the Prevention of Cruelty to Animals.

DIPPING FOR HORSE-SICKNESS.

To the Editor of the *Agricultural Journal*.

SIR,—I have read with interest your notes, in this month's *Journal*, on dipping and the excellent results that have been obtained therefrom. May I add a note on my experience of its apparent value as a protection against horse-sickness? In 1901 I was attached to a mounted column operating in the Zoutpansberg District, and although this was between the months of April and June horse-sickness was very prevalent and fatal amongst the horses and mules of the column. Having been trained, as a youth, in the Old Country as a farmer no doubt suggested to me that dipping might prove of use. At all events on entering the district I procured arsenical dip and made every horse and mule in my charge be thoroughly washed therewith, once a week. I lost 5 per cent. of my animals; the column I was informed lost over 40 per cent. So important did I consider the matter that on coming down to Pretoria in June of that year I visited the veterinary station there and communicated my experience to the Director (Dr. Theiler). Horses and mules may be dipped as easily and inexpensively as cattle and possibly with equally good results, in any case without doing them any harm.—Yours, etc.,

AUXILIUM.

[The above letter was referred to the Acting Director of Veterinary Research, Mr. W. Robertson, who observes:—Dipping as a preventive against horse-sickness has been advocated by several prominent agriculturists in the areas where that disease exists. The Hon. Joseph Baynes, C.M.G., employs this preventive. This Division also has several experiments on these lines running on the bushveld, and though it has never been definitely demonstrated, most observers incline to the belief that the cause of horse-sickness is some nocturnal fly; if this proves to be the case the efficacy of dipping as a preventive can easily be explained.]

GREEN MOULD ON CHEDDAR CHEESE.

To the Editor of the *Agricultural Journal*.

SIR,—I would be glad if you would kindly inform me as to what precaution should be taken to prevent the formation of green mould on the outside of cheddar cheese when the latter have been in the curing room for a month or more. The room is rather damp, but cool, temperature seldom rising above 70° F. Australian steel moulds are used, and the bandage is of ordinary butter muslin. The mould does not penetrate into the cheese but looks unsightly.

Dipping in water about 150° F. has been tried, but although temporary success has been attained, the mould still spreads, much more on some cheeses than on others.—Yours, etc.,

THOS. HAMILTON.

Kokstad, E.G.

[The Superintendent of Dairying (Mr. E. O. Challis) replies:—The appearance of green mould on the outside of cheddar cheese is a very common occurrence in cheese-rooms in this country, and is due principally to the conditions

in many cheese-rooms being favourable to the growth of mould, owing to excessive dampness and want of ventilation. Personally I consider that unless the mould is very excessive it in no way damages the cheese beyond somewhat spoiling its appearance, in fact, in curing rooms where the mould is observed I have often found the cheese to be in better condition, owing to the somewhat humid atmosphere in the room preventing the cheese from drying out, which it is so liable to do in a cheese-curing room where the atmosphere is too dry, and especially so when the temperature is too high. Ventilation is essential in all cheese-curing rooms, especially when same are infested with mould. At the same time, cheese in this country should not be exposed to a direct draught, except on dull days, when the atmosphere outside is moist. To check the growth of mould on your cheese I would advise spraying same with a 4 per cent. solution of formalin and washing your cheese shelves with a 10 per cent. solution. The spray used for the cheese should be extremely fine, resembling a mist more than anything else. This necessitates using a syringe, or spray-pump, with a very fine nozzle. Should you, therefore, decide to adopt this method I could advise you where to procure same in Johannesburg. When you have disposed of this season's cheese, and before starting to make cheese next season, I would suggest that you thoroughly fumigate your cheese-curing rooms with the formaldehyde treatment, which is recommended by Mr. I. Pole-Evans, the Government Plant Pathologist and Mycologist, and is as follows:—For every 1000 cubic feet of space it requires 3 pints of formalin and 23 ounces of potassium permanganate. The procedure to be adopted is: Take an ordinary paraffin tin and place it in a much larger vessel containing a little water. The potassium permanganate is then placed in the paraffin tin and the correct quantity of formalin should be poured on to the potassium. The operator should then leave the room immediately and shut the door of the cheese room at once. The time for exposure to the gas so generated should be from four to six hours. Before starting to fumigate care should be taken to make the curing room as air-tight as possible. When reopening the room the operator should be careful not to enter same immediately, as the fumes inside are very strong. The benefits of fumigating are quite obvious, as the formaldehyde gas penetrates into all the crevices of the rooms and destroys all the spores which propagate the mould-causing trouble.]

FOURTEEN-DAYS' DIP WITH COOPER'S.

To the Editor of the *Agricultural Journal*.

SIR,—The pasturage on my farms Truro and Selo, in the district of Maclear, is sour veld, tick-infested, and an undoubted redwater and gall-sickness area. My cattle dipping tank is completed, and I have my cattle dipped regularly every fourteen days as by law required.

Last week I introduced twenty-four head of cattle from the Wodehouse District (where redwater and gall-sickness are practically unknown) on to my Maclear farm (the infected area). This is probably a great risk. I wish to know if the fourteen-days' dipping in Cooper & Nephews' cattle dip, which has proved itself destructive to the ticks, will protect this lot of cattle from infection by redwater and gall-sickness. The cattle can be rendered immune by inoculation with serum from one of the Government Laboratories, but if dipping is effective I prefer to have no risk from inoculation at the present time.

This information may be of great benefit to many farmers in South Africa, especially to my friends in Maclear, and the advice given will be highly appreciated.—Yours, etc.,

E. VINCENT COTTERELL.

Brabant Lodge, East London.

[The Acting Director of Veterinary Research, Mr. William Robertson, replies:—Mr. Vincent Cotterell is certainly running a risk in introducing clean cattle from the Wodehouse District into Maclear, and though the fourteen-days' dipping will keep the cattle fairly free from ticks it will not keep away redwater with any degree of certainty, so the cattle must be dipped at shorter intervals, not more than ten days, and better at weekly intervals. One tick, suitably infected, can produce the disease in question. There is certainly a risk in their inoculation, as there is in all and every form of preventive inoculation, but I think Mr. Cotterell (unless he has special reasons for acting on the contrary) would be wise in risking the inoculation.]

MAMMITIS IN COW.

To the Editor of the *Agricultural Journal*.

SIR,—A cow gave birth to a calf a couple of days ago, and I found that her udder was very hard, and, on trying to milk her found that three out of four teats were blind and only suckling the calf on one teat.

Last year this same cow had a calf and all the teats were sound. What is the cause of the three teats going blind?

I have been using hot fomentations and embrocation; so far the swelling or hardness of the udder is still there. Is there any other remedy besides this?—Yours, etc.,

GEO. GREEN.

P.O. Vaal Hoek,
Pilgrims Rest, Transvaal.

[The Senior Veterinary Surgeon for the Transvaal (Mr. J. M. Christy) replied:—The cow is suffering from mammitis, or inflammation of three glands of the udder. Give her a pound of epsom salts as a drench in six bottles of water, foment and hand rub the udder twice a day. After fomenting, rub in a little of an ointment made of Venice turpentine one ounce, extract of balladonna one ounce, and vaseline eight ounces.]

GRAZING CATTLE.—MAIZE PLANTING.

To the Editor of the *Agricultural Journal*.

SIR,—I shall be very much obliged if you will tell me (1) how many head ot cattle will graze on 100 morgen of field grass in the summer; (2) how many bags of maize can be planted on 100 morgen of ground; and (3) how many morgen it takes to plant one bag of maize 3 feet wide and 18 inches in the row.—Yours, etc.,

I. S. SERRAF.

Frankfort, Orange Free State.

[The Farm Manager, Experimental Farm, Potchefstroom (Mr. A. Reid), replies:—(1) In the absence of any details as to locality, rainfall, and conditions generally, and assuming that the term field grass applies to a growth on fallow land affording more than ordinary veld grazing, about 200 head of cattle might be grazed on 100 morgen during the summer months. Veld grazing on the average for a year is computed at one head per morgen. (2) and (3) The quantity of seed which requires to be sown per morgen varies greatly on account of the difference in the size of the seed of the several varieties, but taking the following four varieties, which are fairly representative of the several sorts grown in this country, you would require the following quantities:—

Variety.	Weight of seed per morgen in rows 3 feet apart and grains 18 in. in rows.
Chester County Mammoth	16 to 18 lb.
Eureka	18 to 20 lb.
White Cango	20 to 22 lb.
Hickory King	28 to 30 lb.]

MAIZE AND MANGELS.

To the Editor of the *Agricultural Journal*.

SIR,—As a young beginner of farming and an interested reader of your journal, can you assist me with the following information.

I have just fenced off a field, 1000 yards by 1000 yards, on a gentle slope and intend breaking up portion not now under cultivation in order to put the whole field under mealies next season, but I am warned by old residents that the lower portion is no good for maize. The soil at the top of the field is very dark red sandy loam and gradually changes to a brackish clay and ends in black turf. About the centre of the field I have now growing twenty acres maize and it looks well (considering the severe drought), and also eight acres manna, and eight acres teff-grass, which promises well. These lands are right across where the soil changes. Assuming that the field is ploughed in four blocks, each 1000 yards by 250 yards, as sketch.

The lower block is not well drained for very wet weather, and it is inclined to hold water, but the soil is deep and has a very rich appearance. Would it do better for dry-land lucerne than for mealies? I may mention that I plough land 10 inches deep, disk harrow it, and then dray harrow before planting with champion planter.

Mangel-Wurzel.—So pleased was I to see how well cattle do at the Potchefstroom farm on mangels and teff that I determined to try some mangels, and the first week in the new year I planted three acres in rows 2 feet 6 inches apart. The seeds I dropped about 6 inches apart, intending to thin out a little afterwards. These are very disappointing so far, some rows have only a few blanks, but some are quite blank, and I am wondering whether it takes longer for the seed to generate than three weeks. Can you assist me with a pamphlet or otherwise on successful cultivation of mangels for stock?—Yours, etc.,

W. G. WOODHOUSE.

P.O. Losberg.

[The Farm Manager, Experimental Farm, Potchefstroom (Mr. A. Reid), replies:—On the lower portion of the area described as black turf and badly drained lucerne should on no account be planted as it will not do on any soil where water may ordinarily be found at a depth of less than 3 feet. It may come away and do all right for a time, but would gradually die off when once its roots strike the water. On this land I think paspalum would probably be most suitable. The seed should be sown broadcast at the rate of 12 lb. per acre on a well-prepared seed bed. (2) The failure of the mangel crop is undoubtedly due to the drought, providing the ground was in good tilth and manured. Even in ordinary seasons the crop is a delicate one in its early stages, and germinates unevenly unless the weather is favourable and frequent showers occur. Every attention should be given to the preparation of a good seed bed, and the ground should be well manured and the seed sown at the rate of 12 lb. per acre. The crop in question has been too thinly sown.]

SUMMER WHEAT AND OATS.

To the Editor of the *Agricultural Journal.*

SIR,—In a reply to a query in the January *Agricultural Journal re* summer wheat and oats the Agronomist, Bloemfontein, states: "Experience has shown that a paying return in grain is very improbable from a summer crop." Now, not long ago I started farming between Heidelberg and Standerton, and I find it difficult to find out whose advice to follow as to the best month to sow wheat and oats on ground not irrigated, with an annual rainfall about 30 inches. Rain begins in October, and the long rains any time from January to March. I planted one bag wheat last October and it is looking splendid just now. I should be glad to know what months in the above district you consider best to sow oats and wheat. (2) I am digging out Up-to-date potatoes before the end of February. Can I keep these over for seed to plant next October, keeping them in bins covered with ground and thatched?—Yours, etc.,

FARMER.

Heidelberg, Transvaal.

[The Principal, School of Agriculture, Potchefstroom (Mr. E. J. Macmillan), replies:—When the conditions permit, wheat and oats are better grown as a winter crop sown from April to June, according to the varieties and district. Summer grain is very liable to rust, and can only be recommended where the winter crop has for some reason proved a failure. In the Heidelberg and Standerton Districts May is a suitable month in which to sow the later-maturing varieties. Algerian oats, and wheat such as Bobs, may be sown as late as 1st August. The ground should be prepared as soon as possible by deep ploughing—7 to 8 inches, and be followed by cultivation sufficient to keep down weeds and prevent a crust forming. The heavy rains of the summer are thus conserved for the use of the crop that is to succeed, and given a favourable rainfall there should be enough moisture in the soil to carry the grain forward until October, when spring rain may be expected. (2) It is possible to carry over seed potatoes until the month of October in the manner described. The potatoes in the heap or bin should be spread rather thinly, or in other words the heap should not measure more than about 4 feet across or 2 in height. Re-sorting is advisable during the winter season. Usually potatoes from the late crop which matures at beginning of the winter season and may be left in the ground until August are chosen for seed.]

SILO FOR MAIZE.

To the Editor of the *Agricultural Journal.*

SIR,—In the December, 1912, issue there is an article by Mr. J. Burtt-Davy, F.L.S., etc., on the "Preservation and Use of Maize for Stock Feed." I have read this with much interest, and, requiring to erect a silo for the purpose of providing winter feed for twenty head of cattle, I would like to know what the capacity of such a silo should be to enable me to provide 20 lb. per head per day for twenty head over drought period of, say 180 days.

The point I want to get at is, what is the weight of cut maize stalks after being in a full silo for two months and weighted down for that time? How many cubic feet of this material would weigh a ton of 2000 lb.? What capacity should be allowed for shrinkage of the material when building the silo?—Yours, etc.,

PHILIP POWTER.

P.O. Box 8, Umkomaas, Natal.

[The Government Agrostologist and Botanist (Mr. J. Burtt-Davy) replies: The size of the silo to build may be determined from the following particulars: A cubic foot of well-packed silage weighs from 35 to 40 lb. on the average, and this is the amount which dairymen usually feed daily to a cow of about 1000 lb. weight. At this rate one cow will consume 180 cubic feet (about 3¼ tons) of silage in 180 days. A herd of twenty cows would consume 70 tons during the same period. But it is generally considered safer to provide about 25 per cent. extra for waste and damaged silage. You would find much useful information on this and other subjects connected with the feeding of stock in the "Farmer's Cyclopedia of Agriculture," by Wilcox & Smith.]

PATCHY CROPS IN OLD FOREST LAND.

To the Editor of the *Agricultural Journal.*

SIR,—On the above phenomenon you invite correspondence. Although it is with extreme diffidence that I hazard a suggestion on the subject, Mr. Franzsen's description is so suitable to the condition known as "grub" that I cannot refrain from asking the question, "Would not the presence of the larvae of some insect explain both the condition and its cause?—Yours, etc.,

AUXILIUM.

[The above letter was referred to the Chief, Division of Entomology (Mr. C P. Lounsbury), who observes:—There is a chance that the sudden failure of such kinds of crop plants in small patches on recently cleared forest land may be due to soil insects, such as the grubs of chafers or tok-tokjes, which previously fed on the roots of trees or patches of grass that grew amongst the trees. An examination of the roots of the unthrifty crop plants and of the soil in which they are growing should settle the question. The death of wheat in patches through the attack to its roots of grubs which undoubtedly were present owing to a certain weed which had previously infested the land, was discussed on p. 921 of the *Agricultural Journal* for December. The insect in that case was a small grub which ultimately transforms to a snout beetle (kalander), about a quarter of an inch long.]

TREE LUCERNE.

To the Editor of the *Agricultural Journal.*

SIR,—Can any of your readers give me any information about the following: (1) Is there such a thing as tree lucerne? (2) What are the properties of the tree lucerne, if such a tree exists? (3) What is better in a dry district, lucerne or the tree lucerne?—Yours, etc.,

M. VAN NIEKERK.

Ganna Aar, P.O. Niekerk's Hoop, via Prieska.

[The Experimentalist, School of Agriculture, Elsenburg (Mr. P. Fowlie), replies:—(1) and (2) There are two plants which are sometimes called tree lucerne. The true tree lucerne is known scientifically as *Medicago arborea*. It is suited to very warm districts and resists drought very well. If not kept down by stock it may reach a height of 6 to 8 feet. The other plant which is sometimes called tree lucerne is Tagasaste (*Cytisus proliferus*). This plant

is also suited to dry warm districts, and may reach a greater size than true lucerne. Some grown at Elsenburg attained a height of over 6 feet in one and a half years, whilst true lucerne made very little growth, and was only abut 1 foot high in the same time. (3) Where lucerne can be watered I would prefer growing it to either kind of tree lucerne, but tree lucerne, especially the kind called Tagasaste, is worth trying in dry places where lucerne would not do any good.]

SORGHUM AND KAFFIR CORN POISONING.

The following letter has been addressed to the Government Agrostologist and Botanist (Mr. J. Burtt-Davy):—

SIR,—In one of the farming papers there is a statement that sorghum and kaffir corn are, at certain stages in their growth, deadly to pigs.

Can you tell me if this is so; and, if so, when it is dangerous to feed them?

One reason for asking you is that we have had a number of pigs die and we cannot find out the reason, and we have been feeding the above to them.

Thanking you,—Yours, etc.,

COUPER BROS.

Potgietersrust, Transvaal.

[Mr. Burtt-Davy replied:—Young sorghum and kaffir corn are poisonous to stock in certain stages of growth, but only under certain conditions, which are not yet fully understood. We do know, however, that generally speaking these crops are most injurious in the younger stages of growth, i.e. until they are well over 2 feet high. Even then they are not always poisonous, and it is impossible to tell when the crop is going to be injurious or when it is safe; the only safe plan is to prevent stock from eating it when it is young.]

QUICK-GRASS IN MAIZE FIELDS.

To the Editor of the *Agricultural Journal*.

SIR,—Would you kindly advise me on the following. I have a piece of land where quick-grass grows. It is the grass that sends new roots from the stem. One part of it is old lands and I have maize on it, but cannot get ahead of the grass with cultivation; in fact, the roots are so deep that only the tops can be scraped off.

I would therefore like to know how best to plough and what to plant on the land next time, and maize does not do well on it. Also how to prepare the other part of it, which is new ground lying idle for ten years, for cropping next season, and what best to put in.

Thanking you in anticipation,—Yours, etc.,

S. H.

Vereeniging.

[The Principal of the Potchefstroom School of Agriculture (Mr. E. J. Macmillan) replies:—I would recommend ploughing about 5 inches deep, followed by surface cultivation to kill quick-grass. The land should be re-ploughed about 1st May and cultivated with a spring-tooth harrow, or, if this is not available, a spike harrow. The disk harrow is not suitable. Cultivation in this case should be given with the object of separating the grass roots and bringing them to the surface. Continued working of the ground during the dry season, bringing the creeping root stalks to the surface, where they quickly die from exposure to the sun, is the best method of cleaning either old or new ground infested with quick-grass. Any crop which affords an opportunity for cultivation is suitable on ground troubled with quick. Probably potatoes, planted for main crop in December, would prove more successful than maize if the ground is in other respects adapted for a potato crop.]

PREVENTING TOBACCO FROM INTERBREEDING.

To the Editor of the *Agricultural Journal*.

SIR,—I purchased through you 5 oz. of tobacco: 2½ Yellow and 2½ Blue Prior respectively. I have obtained three thousand plants from same. I would be pleased if you would advise me how I could go to work to keep seed

from interbreeding with other varieties, as my lands are so placed that I cannot plant them any distance away from other varieties. Would paper bags answer the purpose? What size? And at what period of the flowering should it be placed on trees?—Yours, etc.,

C. ROTHMANN.

Edenburg, P.O. Idalia, Piet Retief.

[The Chief, Division of Tobacco and Cotton, replies:—The proper method of saving tobacco seed is to place a paper bag (8-lb. flour bags will serve the purpose) over the seed head so soon as it begins to form, tying the mouth of the bag lightly around the stalk of the plant. The best plants, i.e. those nearest to true type should, of course, be selected; and by means of the above method the seed plants are prevented from cross-fertilizing with less valuable plants standing close to them in the field.]

PROTECTING GRAIN AGAINST WEEVIL.

To the Editor of the *Agricultural Journal.*

SIR,—Will any of your readers inform me as to the best means of preventing weevil in grain tanks. We have several tanks of wheat and have just discovered that weevil has got into the grain. Information on the above will be thankfully received.

Since writing the above I have been informed that grain tanks are being condemned owing to the impossibility of preventing weevil and mildew. Can you inform me as to the truth of such a statement?—Yours, etc.,

STANLEY THOMSON.

Bensonvale, Herschel.

[Mr. Claude Fuller, Entomologist, replies:—The most satisfactory way of preserving grain from weevil attack is by tanking or storing in wooden silos. To prevent mildew the tanks must be thoroughly dry before the grain is placed in them, and naturally the grain must be thoroughly dry also. Wet grain, or insufficiently dried grain of any sort, placed in an iron tank is bound to ferment and mildew. Furthermore, the tanks must be under cover; and it is most desirable that they should be wholly shaded so that at no time during the day does the sun strike upon them. Weevils in grain so stored can be readily destroyed with carbon bisulphide. This is placed in a shallow pan *on top of the grain* and the lid of the tank replaced and made air-tight with white lead or some other suitable caulking material. The amount of carbon bisulphide to be used is calculated on the cubic capacity of the tank, 5 pints being used to every 1000 cubic feet. To find the cubic contents of a circular tank halve the diameter and square the result, multiplying this by the height and the result by 3 1-7. This gives the following formula:—

$$\frac{\text{diameter}}{2} \text{ by } \frac{\text{diameter}}{2} \text{ by } \frac{\text{height}}{1} \text{ by } 3\ 1\text{-}7.$$

Example.—A tank 8 feet in diameter and 12 feet in height:

$$\frac{8}{2} \text{ by } \frac{8}{2} \text{ by } 12 \text{ by } \frac{22}{7} \text{ equals } 603\ 3\text{-}7 \text{ cubic feet.]}$$

EXTERMINATING BATS.

To the Editor of the *Agricultural Journal.*

SIR,—I am troubled very badly with bats, hundreds being secreted in the roof on top of the house. Would you kindly advise me of a remedy to exterminate this pest? Do you consider a dose of cyanide and sulphuric acid would kill them? And if so, how strong must the dose be made?—Yours, etc.,

DAN H. DE WET.

P.O. Hankey, via Port Elizabeth.

[Mr. C. Fuller, Entomologist, replies:—In this case the prevention of the ingress of the bats is the only solution of the trouble that can be suggested. The various openings of which the animals avail themselves to go in and out should be noted and gradually reduced by screening. Ordinary wire netting of half-inch mesh would prevent their passage and not interfere with the

ventilation. Having reduced the openings to one, that should be closed after nightfall when the bats are on the wing. To fumigate properly would entail making the roof-space air-tight and collecting the dead bats. Further, so soon as the openings were again unblocked fresh bats would find their way in.]

PROTECTION FROM LIGHTNING.

To the Editor of the *Agricultural Journal.*

SIR,—With reference to the article on lightning by Mr. R. T. A. Innes on page 642, Vol. II, of the *Agricultural Journal*, will you please inform me if any steps should be taken further than those mentioned in the article if your chimneys should be higher than the roof. I should think that in a case like this, the tops of the chimneys being higher than the roof, would attract the lightning down the chimney.—Yours, etc.,

F. VISSER.

Box 23, Wolmaransstad.

[The Chief Meteorologist (Mr. C. Stewart) replies:—In the circumstances mentioned by Mr. Visser the chimneys would form a good striking point, both owing to their height and to the heated air ascending from them. It would be wise to place a metal band around the top of each chimney and to securely fasten and solder to it a stout strip of metal, which should be passed right over the chimney in the form of a semi-circle. At one side where the strip and band join a vertical galvanized iron tube, 20 inches long, should also be firmly fixed and soldered. Through this a central stout fencing wire surrounded by similar wires about 2 inches shorter, all secured together, should be passed until the central wire protrudes about 4 inches. The surrounding wires should then be bent at the top to an angle of thirty degrees with the central wire, and at the bottom should be cut off at the point where they leave the tube. At both ends of the tube the whole of the wires should be well soldered together and to the tube, thus forming a rigid and efficient upper terminal with the central wire leading from it. The central wire should then be led over the roof to a good earth. It should be secured to the roof and soldered well where it joins and leaves it.]

To the Editor of the *Agricultural Journal.*

SIR,—I shall be glad if you would advise me of the best method to construct a conductor on "rondavel" with thatch roof which I intend building shortly on farm.

Some time ago I believe an article on the above subject appeared, but I do not know whether it would apply to this kind of structure as well. Barb wire was recommended; this, no doubt, is cheaper, if it can be fixed.—Yours, etc.,

J. N.

Box 776, Johannesburg.

[The Chief Meteorologist (Mr. C. Stewart) replies:—If the "rondavel" which correspondent proposes to erect has the usual tin at the top I should be inclined to recommend the use of stout fencing wire as a conductor. The upper terminal should rise about 2 feet above the apex of the cone formed by the roof; stability, and at the same time efficiency could be obtained by binding other lengths of wire slightly shorter around the main wire, bending them at the upper end to form branches at an angle of about thirty degrees with it, and then passing the whole through a galvanized tube and soldering securely at both ends. The tube should be securely attached to the roof, and the wires earthed in permanently moist soil at distances around the structure which will depend on the number used. I should rather prefer insulation of the conductor from the thatch.]

PLASTER FOR SUN-DRIED BRICK WALLS.

To the Editor of the *Agricultural Journal.*

SIR,—Can you, or any of your readers who have had experience, say what is the best material for making plaster for sun-dried brick walls?

We have red and black soil here, antheap, sand, potclay (pipeclay), etc. What proportions are best, and what oil dressing (if any) to prevent it washing off. I do not wish to use cement. I would be very thankful for information.—Yours, etc.,

CHAS. T. GORDON.

P.O. Magoye, N. Rhodesia.

[The Lecturer in Engineering at the Potchefstroom School of Agriculture (Mr. W. S. H. Cleghorn) replies:—I would recommend the following procedure which has been found satisfactory on this farm: First coating.—Make with water a mixture containing one part cow-dung to two parts sandy loam (by volume), mixing thoroughly. Allow this mixture to stand for a few days, then mix up again thoroughly, rake out the joints in the brickwork and apply the plaster to a thickness of not more than ¼ inch—leaving the surface rough. Do not wet the walls before applying plaster. Second coating.—After the first coating is thoroughly dry, say about a month after its application, mix up another plaster consisting of clay, with enough sand added to prevent cracking when drying. This second coating may be about ⅜ inch thick. Smooth the surface and, if desired, whitewash when dry.

The correct proportions for this second plaster may be found by making up a trial mixture and applying it to a small area of wall and watching it while it dries. If it cracks, a larger proportion of sand is required in the mixture.]

The Weather during January.

By C. STEWART, B.Sc., Chief Meteorologist, Department of Irrigation.

THE mean air temperature over the Union during the month of January was about 2° above the normal, the day temperature having been about 3° and the night 1° higher than usual.

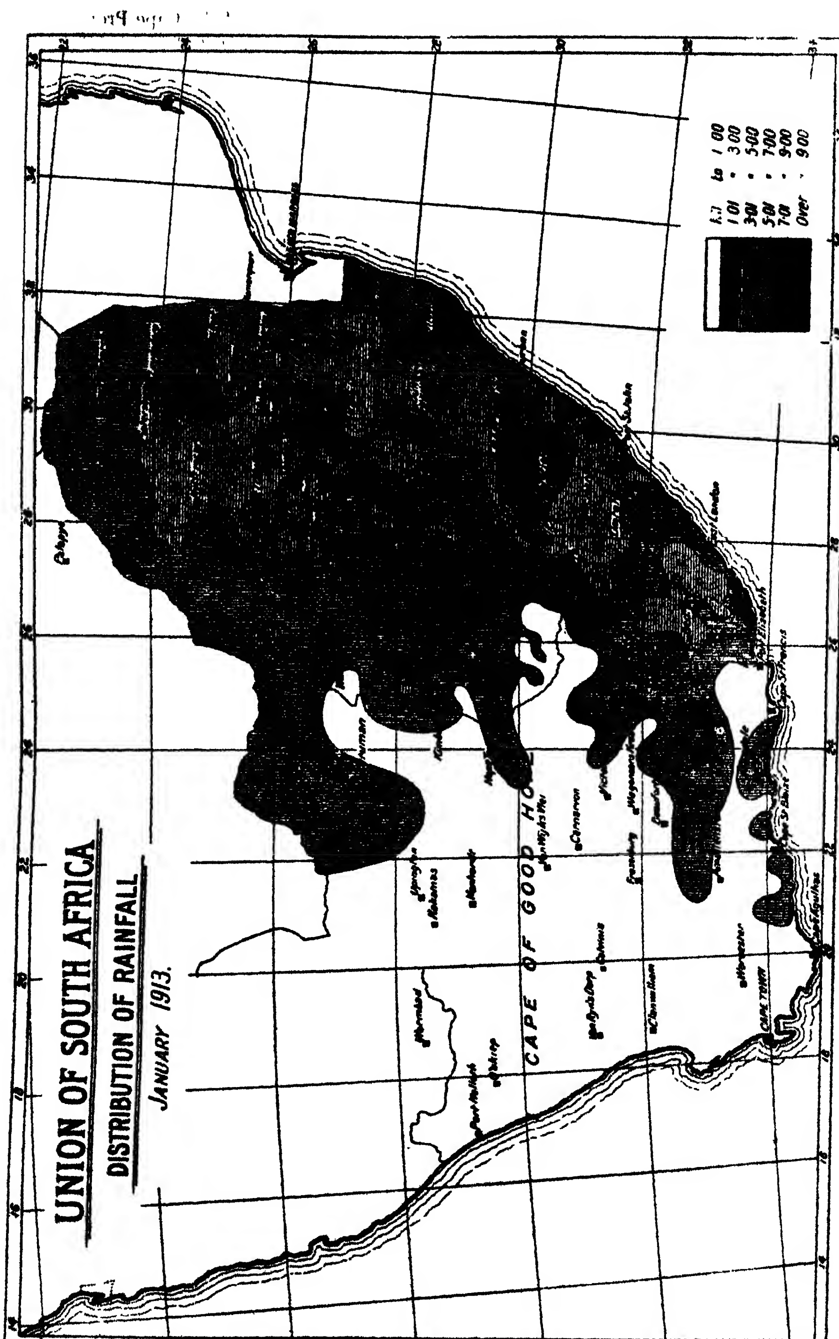
The rainfall was again considerably below the normal, except in Natal, on the southern Karroo, and in the vicinity of Port St. Johns in the Cape, and Belfast in the Transvaal. The rains were generally fairly well distributed over the month, although in Natal there was a dry spell in the middle.

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN THERMOMETER SCREENS)—JANUARY, 1913.

PLACE.	OBSERVER.	MONTH—JANUARY, 1913.			Normal Monthly Temperature.	Difference from Normal.	EXTREMES.			
		Mean Max.	Mean Min.	Monthly Temperature.			Highest.	Date.	Lowest.	Date.
		°	°	°	°	°	°		°	
Transvaal—Louis Trichardt ...	Sergt. J. C. M. Clark	86·8	63·5	74·9	70·6	+4·3	98·0	23rd	54·0	1st.
Pietersburg	W. Frankleyne ...	83·4	60·8	72·1	70·7	+1·4	90·0	27th & 28th	56·0	10th
Belfast	G. J. Imrie ...	72·6	53·3	62·4	—	—	79·1	27th & 28th	47·0	2nd.
Pretoria (Arcadia) ...	J. Lyall Soutter ...	85·1	59·1	72·1	71·8	+0·3	—	—	—	—
Johannesburg (Obser.)	Staff	77·4	55·9	66·7	65·4	+1·3	82·6	19th	47·4	3rd.
Potchefstroom ...	J. R. Stenning ...	89·0	60·0	74·5	70·2	+4·3	97·0	12th	52·6	3rd.
Christiana	S. W. Davis ...	92·6	63·4	78·0	75·1	+2·9	104·0	[illegible]	54·0	4th.
Komatipoort	B. J. Fothergill ...	93·3	68·4	80·8	80·5	+0·3	104·5	23rd & 28th	65·0	4th.
Swaziland—Mbabane	A. C. Hulett ...	76·6	58·2	67·4	—	—	91·0	26th	53·0	20th.
Free State—Bloemfontein	H. Arndt	88·1	60·8	74·4	72·4	+2·0	98·1	26th	54·4	3rd.
Lindley	J. Oates	82·2	57·9	70·0	68·5	+1·5	90·0	27th	49·0	3rd.
Harrismith	J. B. Patterson ...	75·8	51·6	63·7	64·8	—1·1	84·4	27th	44·0	3rd & 11th.
Cape—Hanover	W. J. Myburg ...	89·4	58·3	73·8	69·4	+4·4	96·0	15th	47·0	2nd.
Aliwal North	A. Brown	87·9	55·6	71·8	69·6	+2·2	96·0	26th	47·0	10th
Kokstad	H. D. Coyte ...	76·6	54·6	65·6	66·4	—0·8	90·4	18th	46·2	3rd.
Murraysburg	A. Cameron ...	89·8	58·5	74·2	72·9	+1·3	99·0	16th	43·0	19th
Queenstown	H. Holley	85·6	58·0	71·8	69·4	+2·4	97·0	25th	49·0	31st.
Bedford	T. C. Hall	84·1	58·3	71·2	69·6	+1·6	100·0	17th & 18th	46·0	10th.
East London	M. G. Grogan ...	75·5	63·7	69·6	70·0	—0·4	82·0	22nd	59·0	4th.
Amalienstein	Rev. Paul Prozesky	90·5	60·4	75·4	73·8	+1·6	100·0	14th	53·0	10th
Groot Drakenstein ...	Lionel Baker ...	89·8	62·7	76·2	70·7	+5·5	106·3	14th	52·4	24th.
Capetown (Observat'ry)	Staff	82·7	63·2	73·0	69·3	+3·7	101·7	14th	55·3	5th.
Wynberg	Sister Mary Imelda	81·6	60·6	71·1	67·2	+3·9	95·5	14th	56·0	5th.
Mossel Bay	G. Draper	76·9	62·2	69·5	69·8	—0·3	82·0	17th	54·0	10th.
Port Elizabeth ...	P. E. Morgan ...	77·1	63·5	70·3	69·9	+0·4	83·0	18th, 19th, & 22nd	58·0	10th.
Natal—Durban	Capt. David. Black	82·8	69·9	76·3	—	—	90·0	21st & 23rd	64·0	3rd.
Dundee	Gaoler	85·4	60·0	72·7	72·4	+0·3	97·0	26th	51·0	3rd.
Maritzburg	Natal Asylum ...	84·8	61·2	70·3	73·3	—0·3	104·0	22nd	55·0	3rd & 9th.
Hlabisa	E. D. Lightening ...	83·3	64·4	73·8	—	—	94·0	28th	60·0	2nd, 3rd, & 4th.

RAINFALL RETURNS FOR JANUARY, 1913.

PLACE.	OBSERVER.	January, 1913.	Normal.	Difference from Normal.
Transvaal—Komatipoort ...	H. J. Evans	1·41	4·30	—2·89
Christiana... ...	S. W. Davis	2·93	2·70	+0·23
Belfast	G. J. Imrie	7·35	6·30	+1·05
Pilgrims Rest ...	E. Elphinstone	3·88	8·21	—4·33
Zeerust	H. Dietrich, J.P. ...	1·87	4·89	—3·02
Middelburg ...	Dr. H. A. Spencer ...	4·67	5·34	—0·67
Potchefstroom ...	H. R. M. Bosch	1·05	4·56	—3·51
Pretoria	J. Lyall Soutter... ...	5·54	5·98	—0·44
Rustenburg ...	Transvaal Police ...	2·56	5·32	—2·76
Standerton ...	A. von Backström ...	3·39	4·67	—1·28
Mbabaan	Swaziland Police ...	5·79	9·62	—3·83
Potgietersrust ...	Transvaal Police ...	3·61	5·41	—1·80
Johannesburg ...	The Observatory Staff ...	2·66	5·98	—3·32
Louis Trichardt ...	Sergt. J. C. M. Clark ...	2·15	5·45	—3·30
Pietersburg ...	W. Frankleyne	3·70	3·82	—0·12
Leydsdorp ...	E. E. McCusker... ...	2·08	5·55	—3·47
Piet Retief ...	W. A. Humphries ...	4·08	7·28	—3·20
Natal—Durban	Captain D. Black ...	6·34	4·60	+1·74
Maritzburg ...	Government Asylum ..	6·41	5·62	+0·79
Dundee	The Gaoler	5·63	6·56	—0·93
Hlabisa	E. D. Lightening ...	8·91	5·27	+3·64
Port Shepstone ...	A. B. Cox	2·17	3·82	—1·65
Bulwer	A. Brown	9·27	—	—
Cape—Vryburg	J. T. Morrison	0·90	7·25	—6·35
Pella	Rev. Bishop Simon ...	0·00	0·05	—0·05
Griquatown ...	E. Hanstein	0·91	2·03	—1·12
Prieska	M. Drummer	1·30	1·26	+0·04
Hopetown... ...	C. B. Scott	1·23	2·08	—0·85
Clanwilliam ...	W. J. Downes	0·00	0·23	—0·23
Calvinia	W. Harvey	0·10	0·31	—0·21
Fraserburg ...	P. J. Booysen	0·06	0·81	—0·75
Britstown	P. A. Myburgh	0·33	0·92	—0·59
Carnarvon... ...	J. Sullivan	0·31	1·36	—1·05
Murraysburg ...	A. Cameron	0·58	1·35	—0·77
Philipstown ...	P. H. Kal	0·70	1·80	—1·10
Hanover	W. J. Myburgh	0·49	1·77	—1·28
Aliwal North ...	A. Brown	1·53	3·65	—2·12
Queenstown ...	H. Holley	2·60	3·93	—1·33
Kokstad	H. D. Coyte	5·39	4·68	+0·71
Port St. Johns ...	F. J. Lloyd	7·05	3·99	+3·06
Piquetberg ...	A. H. Morris	0·24	0·51	—0·27
Worcester... ...	W. B. Sutton	0·00	0·38	—0·38
Capetown (Obs.) ...	The Staff...	0·38	0·82	—0·44
Wynberg	Sister Mary Imelda ...	0·44	0·99	—0·55
Sutherland ...	C. R. Bester	0·31	0·56	—0·25
Amalienstein ...	Rev. Carl Prozesky ...	0·48	1·07	—0·59
Swellendam ...	H. Montgomery	0·19	2·72	—2·53
Mossel Bay ...	G. Draper	0·87	1·07	—0·20
Beaufort West ...	W. T. Golledge	1·10	1·08	+0·02
Uniondale... ...	E. J. Stewart	0·88	0·84	+0·04
Knysna	Chas. Wilding	0·22	2·19	—1·97
Graaff-Reinet ...	J. A. Simpson	0·81	1·78	—0·97
Steytlerville ...	P. R. de Wet	1·19	0·91	+0·28
Port Elizabeth ...	P. E. Morgan	0·87	1·23	—0·36
Bedford	T. C. Hall	2·73	3·28	—0·55
Free State—Lindley	I. Oates	1·64	3·62	—1·98
Harrismith ...	J. B. Patterson	4·66	5·05	—0·39
Winburg	J. J. Swartz	1·84	2·83	—0·99
Bloemfontein ...	H. Arndt...	1·52	4·07	—2·55


UNION OF SOUTH AFRICA
DISTRIBUTION OF RAINFALL
JANUARY 1913.

APRIL WEATHER CHARACTERISTICS.

Along the western and southern coasts and in the south-west of the Cape Province, the rains are now increasing; but over the other portions of the Union the decreasing precipitation indicates the advent of autumn and the approach of the dry season. The heaviest rainfall should occur over the Cape Peninsula, where the normal for the month is about 3·00 inches, and in order comes Natal, the south coast, the south-east of the Cape, and Basutoland with 2·5 inches: Kaffraria, the Cape south-western and north-eastern district, and the Orange Free State with 2·0 inches; the Transvaal, Cape northern borders, and the northern Karroo with 1·5 inches; and the southern and central and east-central Karroo and the west coast with 1·0 inch.

The mean daily air temperature is now about 70° on the Transvaal low veld, 68° in Natal, 65° in the Cape south-eastern districts, 64° along the west coast, over the southern Karroo and in the south-east of the Cape, 63° over the Cape south-western districts, 62° over the Cape Peninsula, 61° along the south coast and over the Transvaal high veld, 60° in the Orange Free State, 59° in Basutoland and over the Cape north-eastern districts, 58° on the north and 57° on the Central Karroo. Mild frosts may be expected.

In the Transvaal about 78 %, over the Cape northern borders, 77 %, and over the south-west of the Cape 61 % of the total possible hours of bright sunshine should be enjoyed.

Over the Cape northern borders, north-north-westerly, and over the south-east of the Cape north-easterly and south-westerly winds prevail.

South African Produce Markets.

CAPETOWN.

The Produce Department of the firm of R. Müller, Capetown, reports under date of the 26th February, 1913, as follows :—

Ostrich Feathers.—As stated in my last report, the London auction sales commenced on the 3rd inst and resulted in a decline of 5 % on white primes, first and second whites unchanged; third whites advanced 10 . first and second feminas remained unchanged, whilst third feminas advanced 15 %. An advance of 15 % also was realized for spadonas and boos. Blacks and drabs remained unchanged, also floss. However, medium and short drabs advanced 15 %. Fairly large quantities of feathers were sold in the Capetown market, both by public auction and out of hand. Capetown maintains its reputation for satisfactory prices all round. Prices now ruling are as follows :—

	£	s.	d.		£	s.	d.
Primes	17	0	0	to	28	10	0
First	11	10	0	„	16	10	0
Second whites	8	10	0	„	11	0	0
Third whites	3	10	0	„	6	10	0
Inferior and stalky whites	1	10	0	„	3	0	0
Byocks and fancy	2	0	0	„	10	10	0
Superior feminas	11	10	0	„	16	10	0
First feminas	7	10	0	„	10	10	0
Second feminas	3	10	0	„	7	0	0
Third feminas	2	10	0	„	4	0	0
Greys	2	0	0	„	9	0	0
White boos	1	5	0	„	4	10	0
Light boos	0	17	6	„	2	10	0
Dark boos	0	5	0	„	1	5	0
Inferior boos and tipless	0	1	0	„	0	12	6
Long blacks	3	0	0	to	6	0	0
Medium blacks	1	10	0	„	2	5	0
Short blacks	0	5	0	„	1	0	0
Long floss blacks	1	5	0	„	2	0	0
Medium floss blacks	0	12	6	„	1	2	6
Short floss blacks	0	5	0	„	0	10	0
Long drabs	2	0	0	„	3	0	0
Medium drabs	0	5	0	„	1	15	0
Short drabs	0	2	6	„	0	7	6
Long floss drabs	1	5	0	„	2	0	0
Medium floss drabs	0	12	6	„	1	0	0
Short floss drabs	0	4	0	„	0	7	6
Inferior long blacks and drabs	0	15	0	„	2	0	0
Common blacks and drabs	0	1	0	„	0	5	0
Spadonas	0	10	0	„	4	0	0

Wool.—Moderate quantities of wool have been offered here in the Capetown market, since I reported last. However, all that has been offered sold readily at fairly good prices. At the next London sales there will be 155,000 bales of wool offered for sale, whereof 11,000 bales are of South African origin. The following prices have recently been realized in Capetown, viz. :—

	d.		d.
Calvinia, long	6¼	to	7
Calvinia, medium	6	„	6½
Karroo and Roggeveld	6	„	9⅞
Short burry wools, heavy	4	„	4¾
Short burry wools, light	4¾	„	5¼
C. and C., best grease	4¾	to	5¾
C. and C., medium	3½	„	4¾
C. and C., inferior	1	„	3
Malmesbury	5¾	„	6¾

Skins.—103,000 Cape goatskins were sold at the recent London sales, out of the total quantity of 185,000 skins which had been offered for sale. Light, extra light, and kids declined ½d. to ¾d.; heavy and medium weights were disposed of at former prices; sundried receded ¾d., and bastards by ½d. Dry damaged declined ½d. to ¾d. per lb

Notwithstanding this report from London the Capetown market has only receded ½d., which, after all, must be considered quite good enough.

Sheepskins still realize in Capetown the former high prices.

To-day's Capetown quotations are :—

Goatskins, light	13½d. per lb.
Goatskins, medium	11½d. per lb.
Sundried and kids	8d. per lb.
Angoras	7d. per lb.
Angoras, bastard	10d. per lb.
Angoras, shorn	5½d. per lb.
Caledon	7½d. per lb.
Longwools, Karroo	6¾d. per lb.
Shortwools	5½d. per lb.
Pelts and damaged	4½d. per lb.
Capes, large	3s. 4d. each.
Capes, medium	2s. 6d. each.
Capes, cut	1s. 6d. each.
Capes, damaged and lambs	9d. each.

Hides.—The Capetown market for hides has experienced some considerable improvement. Exporters are paying here now as much as 10d. per lb. for sound hides, and from 7d. to 8d. per lb. for damaged hides.

PORT ELIZABETH.

Messrs. John Daverin & Co. report as follows under date 1st March :—

Ostrich Feathers.—The usual three days' sale was again held this week, the offerings consisting of an ordinary average assortment.

The market opened without change, but became rather easier on Tuesday and Wednesday, and at the close of the market prices of average wings ruled somewhat lower than last week's rates, other descriptions being practically unchanged.

The whole of the offerings were disposed of, however, as prices on the whole must still be considered very satisfactory.

Spadonas, tails, and common wings remain high, while superior quality pluckings are selling very well all round.

The new season's goods are now commencing to come forward rather more freely, and it does not appear likely that any further reduction in stocks will take place.

London brokers' advices, dated 6th February, state :—

> "We think we are safe in saying that prospects for the spring season are good, and that feathers will be in demand, as most fancy birds' plumage are going out of fashion, at least on the continent."

The total quantity sold on our market this week amounted to £26,944. 4s. 7d., and weighed 9590 lb. 3¼ oz.

We quote the following as current prices for :—

	£	s.	d.		£	s.	d.
Primes:							
Extra super	25	0	0	to	35	0	0
Good	15	0	0	„	20	0	0
Whites:							
Good to super	10	0	0	„	12	10	0
Good average	8	0	0	„	9	0	0
Average	6	0	0	„	7	10	0
Common and narrow	3	15	0	„	5	5	0
Good broken	7	10	0	„	10	0	0
Thirds	2	5	0	„	4	10	0
Fancies:							
Good	5	10	0	to	7	0	0
Ordinary	4	0	0	„	5	0	0
Feminas:							
Super	10	10	0	„	14	0	0
Good average	6	10	0	„	8	10	0
Average	4	10	0	„	5	10	0
Common and narrow	2	5	0	„	3	15	0
Good broken	4	15	0	„	7	10	0
Thirds	1	10	0	„	2	15	0

	£	s.	d.		£	s.	d.
Greys:							
Good	4	15	0	to	7	0	0
Ordinary	2	15	0	„	4	0	0
Tails:							
Male, good, big, bold	2	10	0	„	4	0	0
Male, good average	1	15	0	„	2	5	0
Short and narrow	0	17	6	„	1	10	0
Female, light, good, big, bold	2	0	0	„	3	0	0
Female, light, good average	1	10	0	„	1	15	0
Female, light, short and narrow	0	10	0	„	1	0	0
Female, dark, good, big, bold	1	0	0	„	1	15	0
Female, dark, good average	0	15	0	„	0	17	6
Female, dark, short and narrow	0	7	6	„	0	12	6
Blacks:							
Long (special)	4	10	0	„	6	10	0
Long, good	3	0	0	„	3	15	0
Long, fair	1	15	0	„	2	10	0
Blacks—(contd.):							
Long, drabby	1	0	0	to	2	5	0
Medium	1	5	0	„	2	5	0
Short	0	10	0	„	0	15	0
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Drabs:							
Long, special	2	15	0	„	4	5	0
Long, good	2	0	0	„	2	10	0
Long, fair	1	5	0	„	1	15	0
Medium	0	17	6	„	1	10	0
Short	0	5	0	„	0	12	6
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Spadonas:							
Light (special)	4	0	0	„	6	0	0
Light, fair to good	2	0	0	„	3	10	0
Light, narrow	0	17	6	„	1	15	0
Dark	1	0	0	„	2	10	0
Chicks	0	1	6	„	0	5	0

The following may be quoted as the approximate current values of unsorted parcels per line:—

	Whites. £	s.	d.		£	s.	d.	*Feminas.* £	s.	d.		£	s.	d.
Superior pluckings	8	10	0	to	10	10	0	6	10	0	to	8	10	0
Good average lots	6	10	0	„	7	10	0	4	15	0	„	5	10	0
Poor average lots	5	0	0	„	6	0	0	3	5	0	„	4	0	0
Common lots, stalky, narrow, and discoloured	3	15	0	„	4	10	0	2	5	0	„	3	0	0

	Tails. s.	d.		s.	d.	*Blacks.* s.	d.		s.	d.	*Drabs.* s.	d.		s.	d.	*Spadonas.* s.	d.		s.	d.
Good	30	0	to	40	0	20	0	to	40	0	17	6	to	30	0	50	0	to	80	0
Average	17	6	„	25	0	12	6	„	15	0	10	0	„	12	6	35	0	„	50	0
Poor	10	0	„	15	0	8	0	„	10	0	6	0	„	7	6	20	0	„	30	0

It will be understood that for special lots these quotations may be exceeded.

Wool.—But a limited business has been done during the week, and in the case of wasty wools low prices had to be accepted where business had been done.

Light, long, faultless wools show no change. Wools of this description we have sold during the week at 8d., 8¼d., 8½d., and 9¾d., according to condition.

At the catalogue sales on Wednesday 3162 bales were offered, of which only 450 bales were sold. For a large number of lots not even a bid was made. You will gather from this how difficult it is to move heavy, wasty wools, of which the great bulk of the stocks held here is made up.

The London wool sales open on Tuesday next, and the general feeling is that there will be an active demand, with prices well maintained.

We are looking forward with some hope to an improvement in our local market as the London sales progress.

On the public market on Thursday 585 bales were offered, and 352 bales disposed of.

Crossbreds and coarse and coloured continue in demand at unchanged prices.

We quote the following as current prices :—

	d.		d.
Snow-white, extra superior	None offering		
„ superior	21	to	21½
„ good to superior	19	„	20
„ inferior faulty	17	„	18
Grease, super choice clips	10¾	„	11½
Grease, super long, well-conditioned, grassveld grown (special clips)	10	„	10¾
Grease, super long, grassveld grown	9	„	9½
Grease, super long, Karroo grown (special clips)	9¼	to	9½
Grease, super long, Karroo grown	8	„	8¼
Grease, super long, mixed veld	7½	„	7¾
Grease, light, faultless, medium, grassveld grown	7½	„	8¼
Grease, light, faultless, medium, Karroo grown	7¼	„	7¾
Grease, light, faultless, short, Karroo grown	6¼	„	

	d.		d.
Grease, short, very wasty	4¾	to	5¾
Cross-bred grease	6¾	„	9
Cross-bred scoured	14	„	16
Grease, coarse and coloured	5½	„	6½
Scoured, coarse and coloured	9	„	14
Basuto grease, short	6¼	„	6¾
O.F.S. grassveld grease, long and well-conditioned (special clips)	8¼	„	9½
O.F.S. grassveld grease, long and well-conditioned	7¼	„	7¾
O.F.S. grassveld grease, medium grown, light, with little fault	6¼	to	6¾
O.F.S. grassveld grease, short, faulty, and wasty	5	„	5¾
O.F.S. Karroo grown, long and well-conditioned	6¾	„	7¼
O.F.S. medium grown, light, with little fault	6	„	6½
O.F.S. short, faulty, and wasty	4¾	„	5½

Mohair.—Very little business has been done in this article during the week.

The demand for Basuto hair continues, but there is little on hand to satisfy it, and that is being held for higher prices than we quote below.

On the public market on Tuesday 45 bales were offered and 37 bales were sold.

Competition was active and prices showed an advance of ¼d. to ½d. as compared with last week, particularly on mixed descriptions and any type of hair with good length.

The following are current values of—

	d.		d.
Super summer kids	None offering		
Ordinary kids and stained	„		„
Very mixed and stained	„		„
Superior Klips (special clips)	„		„
Ordinary firsts	„		„
Short firsts and stained	„		„
Superfine long blue O.F.S. hair	12	to	13
Mixed O.F.S. mohair (average)	10	„	10½
Mixed O.F.S. mohair, very mixed	9	to	9½
Seconds and grey	7	„	8½
Thirds	4½	„	5
Winter kids, special clips (nominal)	14½	„	14¾
Winter kids, good ordinary	12½	to	13¼
Winter mohair	9¾	„	10¾
Basuto mohair	12	„	12
Basuto mohair, grey	8	„	9

Skins.—The following are the prices we obtained this week for the several descriptions disposed of:—Sheepskins, 6¾d. per lb.; damaged, 5¾d. per lb. Pelts, 4¼d. per lb.; damaged, 3d. per lb. Hair Capes, 2s. 10d. each; sundried, 1s. 10d. each; cut, 1s. each; damaged, 7d. each. Coarse wools, 6d. per lb. Goat, 13¼d. per lb.; heavy, 10d. per lb.; sundried, 10½d. per lb.; damaged, 6d. per lb. Bastards, 11d. per lb.; damaged, 4½d. per lb. Angora, 8½d. per lb.; sundried and heavy, 7¼d. per lb.; shorn, 6d. per lb.; damaged, 3½d. per lb. Johannesburg sheep, 5d.; damaged sheep, 2½d. Pelts, 2¼d. Goat, 10d.; damaged, 5d, Angora, 6½d.; damaged, 2d. per lb.

Hides.—Sundried, 12½d.; damaged, 11½d.; salted, 11½d.; damaged, 10½d. per lb.

Horns.—3½d. each all round.

EAST LONDON.

The Produce Department of Messrs. Malcomess & Co., Ltd., write under date 27th February:—

Wool.—The month of February has brought very little change in the state of this market either in the Province or overseas, and it would appear that the raw article is going steadily into consumption on about the basis of the last London sale's closing rates.

In Bradford prices for tops which at the end of last month were quoted about 28¾d. to 29d. can now be said to vary from 29d. to 29¼d., and for the moment no weakening tendency can be detected.

The continental markets show very fair demand, with holders if anything getting slightly better value than a month ago for whatever they can offer. This feeling is finding its counterpart on this side in the extensive operations of a certain section of the continental trade, by whom large prices have been paid.

The local market has got rid of a very good weight of wool, with prices as firm as ever. All well-conditioned wools are eagerly snapped up and buyers have also commenced nibbling at the heavier wools that have had to be held over as long as lighter classes were obtainable.

The prospects are fairly favourable all round, but one very important factor will have to be taken into account by owners of heavy classes of wool which are still unsold at the various ports.

Buyers, who have been operating very freely and on very high levels early in the season, are beginning to get some of their results in, and the same are proving very disappointing, as we have all along predicted.

The very earthy droughty condition of the wools is now being practically demonstrated by the fact that buyers of all classes of wools have to acknowledge under-yields, in this market as well as in Port Elizabeth and Durban, of 2 to 4 %, representing a loss of ½d. to 1d. per lb. of grease. This naturally means that buyers must readjust their ideas, and in their future operations will be very much more cautious in estimates of yields than in the past, and as many of the heavy wools are already held at prices which are above buyers' ideas, owners up-country may have to show their willingness to do business by slightly reducing their reserves Naturally, when the light wools have been exhausted, the buyers will be compelled to turn their attention to the heavier classes, and a little give-and-take at the right moment on either side may result in a good weight of wool being cleared.

Weekly sales are as follows:—

Sale, 5th February,	4,500 offered,	2,500 sold.	Sales for week, 4,500 bales
„ 12th „	4,500 „	3,000 „	„ „ 5,000 „
„ 19th „	4,200 „	1,500 „	„ „ 4,000 „
„ 26th „	3,000 „	1,200 „	„ „ 3,000 „
	17,200	8,200	Grand total for Feb. 17,500

with stocks in town standing at 9000 to 10,000 bales—mostly of the heavier classes.

Quotations read as follows:—

	d.	d.
Transkeis: practically nothing more available	6½ to	8
Basuto, good to average	6½ „	7
Super short Kaffrarian farmers'	8 „	10
Super long Kaffrarian farmers'	8 „	11½
Super short well-conditioned grassveld	6 „	7¾
Super long well-conditioned grassveld	6½ to	9½
Short faulty grease	4½ „	6
Long „ „	5½ „	7½
C. and C. grease (good average)	4¾ „	6¼
„ „ (very kempy)	2 „	4

Mohair.—Fair business has been doing in this article in Europe, and buyers on this side have been considerably more active, so that very nearly all the local stocks have been cleared at prices that register an advance of quite ½d. to ¾d. over levels ruling at the end of last month.

We quote:

	d.	d.
Best sorted silky full 12 months grown, blue, free from kemp	11½ to	12
Good long blue, silky, full 12 months grown, slightly kempy	11 „	11½
Good to best sorted Basuto hair, up to	11	
Average Basuto hair	8½ „	10½
Sortings according to quality and length	5½ to	7½
Coloured hair, up to	6½	
Good winter hair	9 „	10½
Average winter hair	8 „	9
Super genuine winter kids	12 „	13½

Sundry Produce.—This market during the past month has shown a distinct falling off. Cable news from Europe is none too satisfactory, reading:—"*Goats:* We do not think prices will be maintained. *Angoras:* Prospects are not encouraging. *Sheep:* Expect prices to be maintained. *Hides:* Market has a downward tendency." The result is that hides have fallen very considerably on this side, and buyers have temporarily withdrawn from the market—so that prices must be written down at least a halfpenny as compared with the end of last month. We quote: Sundried hides, 12d.; dry-salted hides, 11d.; goatskins, 13¾d to 14d; angoras, 9½d.; bastards, 10½d. Sheepskins: for super first quality parcels, 7d. to 7¼d.; for C. and C. skins, 5d to 5½d.; pelts, 4½d.; Transkeis, 4¾d. Horns, according to size and quality, 2d. to 3d. each.

DURBAN.

Messrs. Reid & Acutt's Wool Mart, Ltd., Esplanade, Durban, report as follows under date 26th February, 1913:—

Wool.—The month just closed has seen a marked diminution in the quantity of wool handled at this port as compared with the previous month's turnover; and it is evident that the long wool season is now drawing to a close. So far, the quantity of lambs and short wools offering has not been large.

On our weekly auctions held during the month, the general tone of the market has been firm and animated, with a good demand for all long, light-conditioned wools, especially if well-grown. Unfortunately, the majority of the offerings on our recent sales consisted of heavy-conditioned Free State wools, and these have proved somewhat difficult of sale owing to sellers' ideas being too high.

Despite this, however, the majority of the wools catalogued have been disposed of, and stocks remaining on hand are by no means large.

Short and lambs'. wool have not yet come forward in any quantity, but such lots as we have been able to catalogue have been engerly competed for at very full rates; and we anticipate that this brisk inquiry will be well maintained during the season.

Coarse and Coloured Wool continues in very strong demand, good parcels realizing up to 6¾d. per lb.

Mohair.—The quantities offering are somewhat small, but the demand is quite good, and prices recent y have shown a distinct improvement.

The following are the prices current here to-day :—

NATAL AND EAST GRIQUALAND.

Midlands.

	d.		d.	
Sorted clips, light and clean ..	10	to	12	Nominal
Unsorted clips, light and clean	9	„	10½	
Short to medium lambs.......	7½	„	8¼	
Medium to long lambs........	8½	„	9½	

Utrecht and Vryheid.

	d.		d.
12 months' sorted clips, light and clean....................	8½	to	9¼
12 months' average clips, light and clean....................	7¼	„	7¾
6 to 9 months average..........	6½	„	7
Short to medinm lambs........	6¼	„	7½
Medium to long lambs	7½	„	8¼

Ladysmith, Newcastle, Dundee, etc.

	d.		d.
12 months' sorted clips, light and clean	9	to	10
12 months' average clips, light and clean....................	7½	„	8½
6 to 9 months average..........	6¼	„	7
Short to medium lambs.........	6¾	„	7½
Medium to long lambs	7½	„	8½

East Griqualand.

	d.		d.
12 months' sorted clips, light and clean....................	8¾	to	9¼
12 months' average clips, light and clean....................	7¼	„	7¾
6 to 9 months light and clean ...	6¼	„	7
Short to medium lambs.........	6	„	7
Medium to long lambs	7	„	8

TRANSVAAL.

Volksrust, Wakkerstroom, Ermelo, Amersfoort, etc.

	d.		d.
12 months' sorted clips, light and clean....................	9	to	10
12 months' average clips, light and clean....................	7¾	„	8¾
6 to 9 months average..........	6½	„	7¼
Short to medium lambs.........	6½	„	7¼
Medium to long lambs	7½	„	8½

Standerton, Bethal, Middelburg, etc.

	d.		d.
12 months' sorted clips, light and clean	8	„	9
12 months' average clips, light and clean....................	7	„	7¾
6 to 9 months average..........	6	to	6¾
Short to medium lambs.........	6	„	7
Medium to long lambs	7	„	7½

Heidelberg, Pretoria, Potchefstroom, Klerksdorp, Lichtenburg, etc.

	d.		d.
12 months' sorted clips, light and clean....................	7½	to	8¼
12 months' average clips, light and clean....................	6½	„	7¼
6 to 9 months average..........	6	„	6¾
Short to medium lambs.........	5¾	„	6¾
Medium to long lambs	6½	„	7¼

ORANGE FREE STATE.

Harrismith, Vrede, Bethlehem, Heilbron, etc.

	d.		d.
12 months' sorted clips, light and clean....................	8	to	9¼
12 months' average clips, light and clean....................	7½	„	8
6 to 9 months average..........	6¼	„	7¼
Short to medium lambs.........	6½	„	7
Medium to long lambs..........	7	„	8

Lindley, Kroonstad, Vredefort, Parys, etc.

	d.		d.
12 months' sorted clips, light and clean....................	7¾	to	8¾
12 months' average clips, light and clean....................	7	„	7½
6 to 9 months average	6	„	6¾
Short to medium lambs	6¼	„	7
Medium to long lambs	7	„	7¾

Senekal, Ficksburg, Ladybrand, Winburg, etc.

	d.		d.
12 months' sorted clips, light and clean....................	7¼	to	8¼
12 months' average clips, light and clean....................	6¾	„	7¼
6 to 9 months average	5¾	„	6½
Short to medium lambs	6	„	6¾
Medium to long lambs	6¾	„	7½

Coarse and Coloured.

	d.		d.
Free from kemps..............	5½	to	6½
Ordinary	4	„	5
Inferior, kempy, and Persian....	2	„	3½

BASUTOLAND AND NATIVE WOOLS.

	d.		d.		d.		d.
Superior lots, light and clean ...	6½	to	7	Transkei, good ...	7	to	8
Average lots, light and clean....	5½	„	6½	Transkei, ordinary...	6	„	7
Average lots, heavy and wasty ..	5	to	5½				

MOHAIR.

	d.		d.		d.		d.
Kids, good length and super quality	12	to	15	Good winter	8½	to	9½
Long blue, super quality	10½	„	11½	Short and mixed winter........	7½	„	8½
Long blue, average	9½	„	10	Inferior and coloured...........	3	„	6

BASUTOLAND AND NATIVE MOHAIR.

	d.		d.		d.		d.
Good length and quality	9½	to	10½	Inferior and short mixed	6	to	8
Average lots	8½	„	9½				

OSTRICH FEATHERS.

Amongst offerings this week were some superior pluckings which realized up to £20 per lb.

HIDES, SKINS, HORNS, ETC.

Competition very keen at our quotations.

Hides.—Sundried, 14 to 20 lb. average, 10½d. to 12½d. per lb.; sundried, inferior, 8d. to 9d.; salted, 9d. to 10d.

Sheepskins.—Long-woolled, 5½d. to 6½d. per lb.; short-woolled, 3½d. to 4½d. Pelts, 1d. to 2½d.; coarse and coloured, 3d. to 5d.; salted, heavy, 4d. to 5½d.

Goatskins.—Mixed parcels, sound, 4d. to 6½d. per lb.; inferior, 2d. to 3d.

Horns.—3d. to 12d per pair.

Outbreaks of Animal Diseases.

THE following outbreaks of scheduled infectious and contagious animal diseases have occurred in the areas specified during the month ended 28th February, 1913.

C. E. GRAY,
Principal Veterinary Surgeon (Union).

CAPE PROVINCE PROPER.
(EXCLUDING TRANSKEIAN TERRITORIES.)

Anthrax.

District.	Area.	Number of Deaths.	Number of In-contacts.
Alexandria	Nanaga	1	—
"	Bezuidenhoekfontein	3	170
"	Spionkop...	1	—
Barkly West...	Klipdam	3	—
Kingwilliamstown	J. Mpafa's Location	4	391
"	Mnzqaba's Location	1	160
Knysna	Portland	23	
Komgha	Farm No. 222	1	32
"	Farm No. 247	1	20
"	Lot 4/xiii/B23	1	22
Mafeking	Nonen	5	308
"	The Grange and Kameelbult ...	3	125
"	Freshwater	1	25
"	Molopo Native Reserve... ...	5	400
"	Blaauwkrantz and Vogelstruiskop	1	300
Vryburg	Wygeboom Vlakte	2	—

East Coast Fever.

District.	Area.	Number of Deaths.	Number of In-contacts.
East London	Cambridge Commonage and Amalinda	2	2209
Kingwilliamstown	Farm No. 144	1	386
"	Blaney	16	348

Epizootic Lymphangitis.

District.	Area.	Number of Deaths.	Number of In-contacts
Humansdorp	Haukey	1 destroyed	Nil.

Glanders.

District.	Area.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.
Cape	Wynberg...	1	1
Queenstown	Hexagon	1	—
Wodehouse	Dordrecht	1	6

Mange in Equines.

District.	Area.	Number of Animals Affected.	Number of In-contacts.
Alexandria	Village	1	—

Tuberculosis.

District.	Area.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Cape	Various	189	19	1
Malmesbury	"	45	Nil	Nil
Paarl	"	19	Nil	Nil
Stellenbosch	"	57	4	Nil

TRANSKEIAN TERRITORIES.

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Kentani	Yonzama's Location	—	—
"	Velebayi's Location	—	—
"	Nombanyana's Location ...	—	—
"	Dalweni's Location	—	—
"	Simanga's Location	—	—
Mount Fletcher	Commonage	1	194
Mount Frere...	Village	—	—
Butterworth	Toleni	3	11
"	Luzipo's Location	1	2
"	High View	1	4
Nqamakwe	Mavuso's Location	1	43
"	Ncisininde's Location	1	7
"	Nobanda's Location	—	—
"	Sobekwa's Location	—	—

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Butterworth	Lot 4, 4A, 23, 73, Uthlambe ...	—	—
"	Zazani's Location	—	—
Tabankulu	Jesse Ntondini's Location ...	6	1292
"	Dalindyebo's Location	416	1150
"	Mabuda's Location	-	—
"	Vembindlela's Location ...	--	—
Umtata	Annandale	1	100
"	Glen Avon	1	88
"	Nqweniso's Location	2	—
Nqamakwe	Sinquambu's Location	1	39
"	Hloboo's Location	1	208
Idutywa	Ginyigazi's Location	3	309
Mount Ayliff	Mnikwa's Location	—	—
"	Mamkazini's Location	-	—
"	Kwalukwalu's Location ...	—	—
"	Galanga's Location	-	—
Umzimkulu	Mkili's Location	—	--
"	Pansi's Location	1	400
"	Malenge Farm	—	—
"	Lourdes Mission	-	
"	Umzimkulu Commonage ...		—
Mount Currie	Kruisspruit	—	—
"	Koppieskraal	—	—
Mount Frere...	Manla's Location	—	..
Tsolo	Ntaba's Location	1	419
Qumbu	Tiyo's Location	—	—
"	Commonage	—	---
Kentani	Komani's Location	7	253

Lung-sickness.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Umtata	Joseph Balo's Location... ...	5	32
Nqamakwe	Peko's Location	2	75
"	Ezolo Location	1	56

Mange in Equines.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Idutywa	Tatsalas	—	2

NATAL.

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Bergville	Waterloo...	(Not to hand)	—
"	Zandspruit	"	—
Estcourt	Rustenburg	3	639
Ixopo	Norwood	(Not yet to hand)	—
"	Lot 42, Dronkvlei	"	—
Ladysmith	Union	"	—
Polela	Impongweni	"	—
"	Border View No. 879	"	—
"	F.P. 247	"	—
Vryheid	Forlorn Hope	3	23
"	Mademoiselle	2	90

Epizootic Lymphangitis.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Lower Tugela	Nonoti	2	4

Tuberculosis.

District.	Area.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Ixopo	Maxwell	247	51	3

TRANSVAAL.

East Coast Fever.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Zoutpansberg	Highlands No. 2426	1	66

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Witwatersrand	Vlakfontein	—	—
"	Benoni	1	—
"	Driefontein No. 1	1	—
"	Germiston	3	—
"	Klippoortje No 2	1	16
"	Randklipfontein	2	278
"	Pulfontein No. 21	1	27
"	Modderfontein	1	200
Marico	Stinkhoutboom No. 269 ...	1	50
Lichtenburg...	Kyl No. 345	1	100
"	Lichtenburg Town	1	2500
Potchefstroom	Ventersdorp	2	—
"	Government Farm	3	—
"	Wolverpan No. 2	1	—
"	Townlands	2	—
"	Koedoeslaagte	11	150
"	Roodepoort No. 22	1	—
Krugersdorp...	Koodeto rt	12	211
"	Vogelstruisfontein	1	26
"	Roodepoort	1	39

Mange in Equines.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Piet Retief	Townlands	—	5

Lung-sickness.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Zoutpansberg	Pigeon Hole No. 2334 ...	1	41

Tuberculosis.

District.	Area.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Krugersdorp ...	-	1 pig	1	—

ORANGE FREE STATE.

Anthrax.

District.	Name of Farm.	Number of Deaths.	Number of In-contacts.
Boshof	Kleinfontein	10	117

Tuberculosis.

District.	Area.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Lindley	Castlebar	—	1 pig	—
Vredefort	Pompoenkraal	36	3	Nil

Farm Employment.

Applicant, aged 28, is anxious to obtain employment on a farm at terms to be arranged. Has spent most of his life in farming in this country, and is specially interested in farm machinery and the manipulation thereof, of which he has a good knowledge. Married. Dutch-speaking, and possesses a slight knowledge of English.—G. L. EHLERS, Berg Rivier Mond, via Vredeboek, Malmesbury. [12]

Employment is desired by manager, 39, on tobacco or fruit farm. Experienced in tobacco growing and general farming.—C. A. FAIRLIE, 46 Esselen Street, Johannesburg. [12]

Management of farm wanted by thoroughly experienced young man. Thorough knowledge of ostriches and lucerne growing.—C. SCHEEPERS, Post Restante, Jeppe. [12]

A healthy, steady young man of 22 years of age, unmarried, desires situation on a farm. Born in South Africa. Thoroughly acquainted with general farming business. Not afraid to do work of any kind on a farm.—H. R. WATKINS, Smalpoort, P.O. Ida, Elliot, C.P. [1]

Applicant, 21 years of age, with knowledge of simple book-keeping, desires employment on a farm. No experience of South African farming, but is willing to learn.—ALEXANDER SIDDENS, P.O. Box 691, Capetown. [1]

Employment on farm is sought by a young German, 26 years of age. Married (but wife would not accompany him on farm). Has had good experience of farming, and horse and cattle breeding. Three years on intensive farms in Germany as manager, and can show good testimonials. Good education. Speaks English and Dutch.—FRITZ BAUM, Friederichsruh, P.O. Ida, via Indwe, C.P. [1]

Applicant, age 29, single, steady, desires to obtain situation on farm anywhere in the Union of South Africa. Accustomed to working with horses and oxen; understands all kinds of farming—agricultural and stock—and all up-to-date dairy work, calf rearing and feeding. Has had nine years' experience in South Africa.—H. H. WILLEY, South Coast Junction, Durban, Natal. [1]

Applicant, age 28, single, with some experience of agriculture, desires situation for purpose of gaining experience of general farming (crops and live stock). Speaks English, Dutch, and Kaffir.—W. M. BAKER, 230 Visagie Street, Pretoria. [2]

Situation desired as farm manager.—P. S. CAMPBELL, Fort Beaufort. [2]

Opportunity for European lad, about 17 or 18 years of age, to learn farming, with special reference to tobacco, lucerne, ostrich, sheep and cattle farming, dairy farming.—J. C. RAUBENHEIMER, Seymour, C.P. [2]

Advertiser, with Free State and Rhodesian experience, desires post as manager, on salary or share basis. Preferably would like to meet man with capital and farm, who would go in for trees and side lines.—F. R. C. I., c/o *Agricultural Journal* Office. [2]

Situation wanted on farm as general learner by youth of eighteen, strong and willing. Would sign contract for definite period, providing that there are good prospects.—U. W., c/o *Agricultural Journal* Office. [3]

Management of farm wanted by experienced farmer; large and small stock and agriculture. Age 38. Ten years' South African experience.—M., Box 5230, Johannesburg. [3]

Agricultural Show Dates, 1913.

Secretaries of Societies which propose holding shows during 1913, the dates of which do not appear in the following list, are invited to send particulars at the earliest opportunity.

CAPE PROVINCE.

Somerset East, 14th and 15th March.
Aliwal North, 18th and 19th March.
Barkly East, 19th and 20th March.
Humansdorp, 19th and 20th March.
Grahamstown, 26th and 27th March.
Port Elizabeth, 1st to 4th April.
Kimberley, 8th to 10th April.

TRANSVAAL.

Carolina, 19th March.
Standerton, 19th and 20th March.
Wakkerstroom, 20th March.
Johannesburg, 26th to 29th March.
Potchefstroom, 23rd and 24th April.
Heidleberg, 23rd and 24th April.
Klerksdorp, 14th May.
Pretoria, 22nd to 24th May.
Rustenburg, 30th and 31st May.
Waterberg, 20th May.
Wolmaransstad, 4th and 5th June.
Pietersburg, 11th and 12th June.
Barberton, 4th July.
Klerksdorp.—No show owing to drought.

NATAL.

Vryheid, 6th June.
Ixopo, 19th June.
Umvoti, 20th and 21st June.
Alexandra, 24th June.
Pietermaritzburg, 25th to 27th June.
Durban, 2nd to 4th July (provisional dates).
Stanger, 9th July.
New Hanover, 10th July.
Richmond, 25th July.

ORANGE FREE STATE.

Frankfort, 18th and 19th March.
Fauresmith, 18th and 19th March.
Boshoff, 19th and 20th March.
Smithfield, 18th and 19th March.
Bethlehem, 19th and 20th March.
Edenburg, 25th and 26th March.
Hoopstad.—Show cancelled.
Harrismith, 1st and 2nd April.
Heilbron, 2nd and 3rd April.
Winburg, 9th and 10th April.
Bloemfontein, 15th to 17th April.
Ladybrand.—No show will be held, owing to drought.

Current Market Rates of Agricultural Produce and Stock.

The following **Table of Current Market Rates of Agricultural Produce and Live Stock** on Saturday, 1st March, 1913, ruling at the several Centres named, is published for general information.

Centre.	A. Wheat per 100 lb.	B. Wheat Flour per 100 lb.	C. Boer Meal per 100 lb.	D. Mealies per 100 lb.	E. Mealie Meal per 100 lb.	F. Barley per 100 lb.	G. Oats per 100 lb.	H. Oat-hay per 100 lb.	J. Lucerne Hay per 100 lb.	K. Potatoes per 100 lb.	L. Tobacco (Boer Roll) per lb.	M. Beef per lb.	N. Mutton per lb.	O. Fresh Butter per lb.	P. Eggs per dozen.	Q. Cattle (Slaughter).	R. Sheep (Slaughter).	S. Pigs.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	s. d.	£ s. d.
Cape Province:																		
Aliwal North ...	11 6	23 0	30 0	20 0	23 0	15 0	16 6	7 6	6 0	25 0	1 0	0 8	0 6	1 3	1 6	12 10 0	18 0	*2 15 0
Beaufort West ...	12 6	17 9	13 6	10 6	10 6	9 0	8 3	4 6	5 0	14 0	1 0	0 6	†0 5	1 6	1 6	13 0 0	13 0	5 0 0
Capetown ...	9 6	—	—	—	—	9 0	7 0	4 2	6 3	9 8	‡0 5½	—	—	1 3	1 6	—	—	—
East London ...	9 6	18 6	30 0	6 6	13 6	5 0	6 6	5 6	6 0	10 0	1 0	0 4	0 5	1 0	1 6	15 0 0	20 0	1 10 0
Grahamstown ...	10 0	—	—	11 0	—	7 6	7 9	6 1	—	11 3	1 0	0 5	0 5½	1 3	1 10	—	—	2 0 0
Kimberley ...	12 6	15 6	15 6	11 0	9 0	7 0	5 6	6 6	6 6	11 0	0 5	0 6	0 5	1 0	1 9	13 0 0	14 0	3½d. p. lb.
Kingwilliamstown	11 3	18 9	14 6	11 0	11 9	9 0	9 0	6 6	5 0	10 6	0 8	0 6	0 6	1 0	1 6	13 0 0	21 0	4d. p. lb.
Port Elizabeth ...	10 6	—	—	10 6	—	7 6	7 6	5 9	—	13 0	—	0 7	0 7	1 6	2 0	—	—	2 0 0
Queenstown ...	12 6	—	—	11 0	—	—	—	—	5 0	10 0	—	—	—	1 0	2 0	—	—	—
Natal:																		
Durban ...	—	—	—	—	—	—	—	—	3 3	7 0	—	—	—	1 3	2 5	—	—	—
Pietermaritzburg	10 6	—	—	10 3	—	11 6	9 0	6 3	4 0	7 0	0 4	0 5	0 6	1 3	2 5	—	—	—
Transvaal:																		
Pretoria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Johannesburg ...	11 6	—	—	11 0‖	9 2	9 0	8 4	6 9	4 6	8 0	0 3½	—	—	1 1	2 6	—	—	—
Orange Free State:																		
Bloemfontein ...	12 0	—	—	11 0	—	—	—	4 6	4 6	7 6	0 6	0 9	0 5	1 3	1 9	—	—	—
Harrismith ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Average, £2. 10s. to £3. † Average, 5d. and 6d. ‡ Average, 4d. to 7d. ‖ White.

Importation of Live Stock.

RETURN showing particulars of certain Pure-bred Live Stock imported into the Union of South Africa.

Stud-book Number or Name.	Breed and Stud-book in which registered.	Sex.	Country of Origin.	Importer's Name and Address.
HORSES:—				
"Bantam King"	Thoroughbred.—English Stud-book, Vol. XXXII ...	Stallion	England	H. F. Seale, Adderley Street, Capetown (14/1/13).
"Golden Filly"	" " Vol. XXI ...	Mare	"	" " "
"Coal Strike"	" " " ...	"	"	W. McGregor, Maitland, Cape Province (27/1/13).
"Whiff"	No particulars	"	U.S.A.	H. F. Seale, Claremont, Cape.
CATTLE:—				
"Neeltje XIV," No. 3950...	Rotterdam Herd-book	Cow	Holland	Stamper and Lowtendyk (30/1/13).
"Barnestra II," No. 3286...	"	"	"	" "
"Mijntje," No. 6225 ...	" "	"	"	" "
"Hendrika II," No. 2723...	" "	"	"	" "
"Helena I," No. 4229 ...	" "	"	"	" "
"Melkbron I," No. 3468 ...	" "	"	"	" "
"Petronella I," No. 4228 ...	" "	"	"	" "
"Max," No. 716	" "	Bull	"	" "
"Louis," No. 1135 ...	" "	"	"	" "
"Hugo," No. 919	" "	"	"	" "
"Totnes," No. 4212 ...	South Devon.—Herd-book Supplement to Vol. XIII, page 32	"	U.K.	H. L. Southey, Steynsburg, Cape Province.
"Hernaford Councillor" ...	South Devon.—Proposed for entry, Herd-book Vol. III	Bull calf	"	" " "

"Payne 8th," No. 10208 ...	South Devon.—Herd-book, Vol. XII, page 220... ...	Heifer	U.K.	H. L. Southey, Steynsburg, Cape Province.
"Dainty," No. 9377 ...	" " " " 85... ...	"	"	" " "
"Ruby 3rd," No. 10209 ...	" " " " 220... ...	"	"	" " "
"Tulip 2nd," No. 10210 ...	" " " " 220... ...	"	"	" " "
"Pansy 3rd," No. 11008 ...	" " Vol. XIII, page 88... ...	"	"	" " "
"Curly," No. 9376 ...	" " Vol. XII, page 85... ...	"	"	" " "
"Pansy 2nd," No. 10207 ...	" " " 219... ...	"	"	" " "
"Leigham Boy 2nd" ...	South Devon.—Proposed for entry, Herd-book Vol. XIII	Bull	"	Grepe Brothers, Dewetsdorp, O.F.S. (14/2/13).
"Spuddlescombe Fashion"	" " "	"	"	" " "
"Stancombe Monarch," No. 4199	South Devon.—Supplement to Vol. XIII, Herd-book, page 31	"	"	" " "
"Pamfleet Royal Star," No. 4138	South Devon.—Supplement to Vol. XIII, Herd-book, page 32.	"	"	" " "
"Well Bred," No. 4243 ...	South Devon.—Supplement to Vol. XIII, Herd-book, page 36	"	"	" " "
"Pretty Face 7th" ...	South Devon.—Proposed for entry Herd-book, Vol XIII	Heifer	"	" " "
"Pretty Face 4th," 10001	South Devon.—Herd-book, Vol. XII, page 196 ...	Cow	"	" " "
"Gentle," No. 5946 ...	" " Vol. IX, page 174 ...	"	"	J. O. Southey, Steynsburg, Cape Province (14/1/13).
"Hobleton Queen," No. 8060	" " Vol. XI, page 107 ...	"	"	H. L. Southey, Steynsburg, Cape Province (14/2/13).
"Gentle 8th," No. 10205	" " Vol. XII, page 219 ...	"	"	" " "
"Countess King," No. 4024	" " Vol. XIII, page 10 ...	Bull	"	" " "
"May Girl 2nd," No. 10077	" " Vol. XII, page 205 ...	Cow	"	" " "
"Nellie 10th," No. 10079	" " " " ...	"	"	" " "
"Milkmaid 3rd," No. 10078	" " " " ...	"	"	" " "
Not stated	Devon.—No particulars	Bull	"	J. Boyce, Bethlehem, Orange Free State (8/2/13).
"	" "	Cow	"	" " "
"	" "	Not stated	"	" " "
PIGS:—				
"Cornwood"	No particulars	Boar	"	Alfred Barlow, Brereton, Wolvehoek, O.F.S. (9/2/13).
"Drayton Chinella III" ...	"	Sow	"	" " "
Not stated	"	Boar	"	H. W. Barraclough, Roodewal, O.F.S. (8/2/13).
"	"	Sow	"	" " "

Departmental Notices.

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TOBACCO SEED.

The Tobacco and Cotton Division will have a quantity of selected and acclimatized tobacco seed of heavy and bright types for distribution about June, 1913. All applications for seed must reach the Chief of the Tobacco and Cotton Division, P.O. Box 516, Pretoria, not later than 1st May, 1913.

This seed will be distributed pro ratio at a charge of 1s. per oz. Each applicant will be informed soon after the 1st May what quantity can be supplied and the seed will be dispatched so soon as the cash is remitted.

Turkish Tobacco Seed: The following varieties of Turkish seed can be obtained from the Officer in Charge of Turkish Tobacco Experiments, La Motte, Paarl, Cape Province, at the prices quoted, viz.:—

Soulook	4s. per oz.
Malcadje	4s. „
Baladovari	4s. „
Dubeck	5s. „

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

CLEANING AND GRADING TOBACCO SEED.

The Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, are prepared to clean and grade tobacco seed sent to them by farmers free of charge.

The process separates the light from the heavy seed, and the result is that a much larger percentage of the cleaned seed will germinate.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

COTTON SEED.

Selected seed of several varieties of American Upland Cotton can be obtained from the Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, at a charge of 3d. per lb.

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

VETERINARY RESEARCH LABORATORY, ONDERSTEPOORT.

Admission of Visitors.

It is hereby notified for the information of the public that visitors cannot be admitted to the Veterinary Research Laboratory at Onderstepoort during working hours on weekdays unless a special permit has previously been obtained from the Secretary for Agriculture.

The most convenient time for visitors to be shown over the Laboratory is Sunday afternoon, when an officer will be specially detailed for the purpose and permits will not be required.

EXPERIMENTAL FARM, POTCHEFSTROOM.

Seeds for Disposal.

Wheat.—Price 12s. 6d. per 100 lb. delivered at buyers' station. This price is subject to alteration without notice.

Early and Medium Early Varieties suitable for Irrigated Land.—Wit Klein Koren; Rooi Wol Koren; Spring; Glujas Early; Eckstein; Bombay; Fourie; Australian (Early); Hawkesbury; Egyptian Red.

These seeds consist of different varieties which have been experimented upon at this Farm, and have proved valuable; the crops thereof have been specially grown for seed purposes.

Application for these seeds should be made on or before the 15th March. No orders will be booked until that date, but applications may then be closed, and the available supply distributed pro rata among the different applicants. In that case only orders which have been

then definitely placed will be considered; an inquiry which is still the subject of correspondence will not be considered a definite order. These "seeds" will not be forwarded on the c.o.d. system.

Orders must be accompanied by remittance, and cheques and money orders should be drawn in favour of the Principal, Experimental Farm, Potchefstroom, from whom any further particulars may be obtained.

H. THOMPSON,
for *Principal*.

27th January, 1913.

FOWLS FOR SALE AT GROOTVLEI EXPERIMENT STATION, ORANGE FREE STATE.

A number of cockerels and pullets of the following breeds are ready for sale from the Grootvlei Experiment Station:

White Leghorns. White and Silver Wyandottes. Plymouth Rocks.

Applications should be addressed to the Poultry Manager, Grootvlei, P.O. Bloemfontein

PIGS FOR SALE.

Large white Yorkshire and Berkshire Pigs are for sale from the Tweespruit Stud Farm, P.O. Tweespruit, and large Blacks and Berkshires from the Roodepoort Stud Farm, P.O. Dewetsdorp. Inquiries should be addressed to the Managers of the farms mentioned.

ORGANIZATION OF DEPARTMENT OF AGRICULTURE.

Administrative Office ... ... Pretoria.
Telegraph Address ... ... "Landbouw, Pretoria."

Secretary for Agriculture: F. B. Smith. Under-Secretaries for Agriculture: P. J. du Toit and A. Holm. Deputy-Accounting Officer: J. Collie. Chief Clerk: G. N. Williams. Officer in Charge of Inquiry Office, Capetown: G. W. Klerck.

VETERINARY DIVISION.

This Division endeavours to prevent the introduction of contagious diseases of live stock into the Union and to eradicate such as are already present, and to protect live stock against enzootic diseases by inoculation and other means. So far as it is able to do so without interfering with its other duties, the Division advises and assists farmers upon diseases of stock generally and endeavours to enlighten them upon veterinary hygiene and the care of live stock. For veterinary purposes the Union is divided into five areas, each in charge of Senior Veterinary Officers, who are responsible for the control of disease within these areas.

Principal Veterinary Officer: C. E. Gray. Assistant Principal Veterinary Officer: J. D. Borthwick.

Cape Province.—Senior Veterinary Officer: R. W. Dixon, Government Offices, Parliament Street, Capetown. Government Veterinary Officers: C. S. Elphick, Vryburg; E. Fern, Capetown; A. Matthews, Capetown: G. W. Freer, Uitenhage; R. I Jones, East London: J. H. L. Lyons, East London; J. Nichol, Kingwilliamstown; W. G. Pakeman, Queenstown; and W. A. Simson, Cradock.

Transvaal.—Senior Veterinary Officer: J. M. Christy, Department of Agriculture, Pretoria. Government Veterinary Officers: R. S. Garraway, Pretoria; W. G. Evans, Volksrust; P. Conacher, Johannesburg; J. G. Bush, Krugersdorp; T. H. Dale, Potchefstroom; H. M. Webb, Zeerust; J. M. Tate, Rustenburg; J. Chalmers, Nylstroom; J. I. Edgar, Pietersburg; G. Lee, Lydenburg; G. C. Webster, Barberton; D. B. J. McCall, Ermelo; and G. May, Standerton.

Natal.—Senior Veterinary Surgeon: W. M. Power, Colonial Buildings, Piëtermaritzburg. Government Veterinary Surgeons: S. H. Ewing, Eshowe; A. F. Harber, Point, Durban; S. I. Johnston, Maritzburg; F. J. Hill, Bulwer; A. Goule, Maritzburg; J. L. Webb, Mooi River; C. Tyler, Ladysmith; and F. Hutchinson, Dundee.

Orange Free State.—Senior Veterinary Surgeon: A. Grist, Government Buildings, Bloemfontein. Government Veterinary Surgeons: J. F. Joyce, Ficksburg; J. A. A. Hamilton, Kroonstad; F. M. Skues, Bethlehem; C. H. Wadlow, Smithfield; and C. T. Clemow Frankfort.

Transkeian Territories.—Senior Veterinary Officer: J. Spreull, Umtata. Government Veterinary Surgeons: A. C. Kirkpatrick, A. M. Howie, T. M. Doyle, W. A. Dykins, A. Goodall, G. T. Henerson, and J. A. Worsley.

DIVISION OF VETERINARY RESEARCH.

The duty of this Division is the investigation of diseases of live stock with a view to discovering methods of eradicating them or of protecting animals against them. It examines and reports upon pathological specimens forwarded by the Veterinary Division and farmers and prepares vaccines and sera of various kinds, and also mallein, tuberculin, and other diagnostic and preventive agents.

Opportunities are offered to post-graduate students for the carrying out of specia investigations and a great deal of educational work is performed by the Division.

The Division is in close touch with and is complementary to the Veterinary Division. Director of Veterinary Research: Dr. A. Theiler. Assistant Director of Veterinary Research: W. Robertson. Superintendent: E. Parkes. Professional Assistants: D. T. Mitchell W. H. Andrews, D. Kehoe, F. Veglia, W. Jowett, G. N. Hall, G. A. H. Bedford, A. W Shilston (Pietermaritzburg), and J. Walker (Grahamstown).

DIVISION OF SHEEP.

This office is charged with:—(*a*) Eradication of scab; (*b*) improvement of pastora ndustries; (*c*) the management of the Stud Sheep Farm at Ermelo: (*d*) the improvement of the flocks maintained on the various Experimental Farms; and (*e*) the control of the Field Cornets in the Transvaal Province.

Chief of Division: B G. L. Enslin. Principal Sheep Inspector: A. G. Davison. Principal Sheep and Wool Expert: Charles Mallinson.

For the better carrying out of the work in connection with scab, the Union is divided into twenty-four areas in charge of Senior Sheep Inspectors; these areas are in turn divided into 297 inspection districts, each in charge of an Inspector. In addition there are ten Inspectors employed on the railway lines for the prevention of the movement of infected stock by rail. There are also five whole-time Inspectors employed on certain large commonages.

A similar organization is adopted in respect of the improvement of sheep and wool.

Orange Free State Province.—Sheep and Wool Expert: J. F. McNab, Bloemfontein. Assistant Sheep and Wool Expert: A. V. M. Suter, Bloemfontein.

Cape Province.—Sheep and Wool Expert: W. M. McKee, Queenstown. Assistant Sheep and Wool Experts: E. V. Goddefroy, Worcester; P. S. Taylor, Steynsburg.

Transvaal Province.—Western District Assistant Sheep and Wool Expert: A. M. Spies, Headquarters not yet fixed. Eastern District Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal.

Natal Province.—Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal. This area includes the East Griqualand District of the Cape Province.

Manager, Ermelo Stud Sheep Farm: A. G. Michaelian.

DIVISION OF ENTOMOLOGY.

This Division obtains and disseminates information relative to beneficial and injurious "insects." In collaboration with the Division of Plant Pathology, it administers the law relating to the introduction of plants into the Union and by the inspection of nurseries and other methods, it endeavours to control injurious "insects" present in the Union; it is also responsible for the destruction of locusts.

Chief of Division: C. P. Lounsbury. Entomologists: Claude Fuller and C. P. v. d. Merwe, Pretoria; C. W. Malley, Capetown; .... Bloemfontein; and C. B. Hardenberg, New Hanover, Natal (investigating wattle insects).

DIVISION OF BOTANY.

This Division is concerned with the investigation of the merits of indigenous plants of economic importance and of poisonous plants and noxious weeds, the identification of plants, the introduction and testing of economic plants from abroad and the improvement of farm crops by breeding.

Chief of Division: J. Burtt-Davy. Herbarium Assistant: Miss C. Stent.

DIVISION OF PLANT PATHOLOGY AND MYCOLOGY.

This Division in engaged in the investigation and control of diseases of plants, produced by fungous and physiological causes, and the study and collection of fungi of economic importance.

Chief of Division: I. Pole Evans. Professional Assistants: Miss E. M. Doidge and P. v. d. Byl.

DIVISION OF TOBACCO AND COTTON.

The object of this Division is the promotion of the tobacco and cotton industries. Experiments are conducted in the breeding and growth of tobacco and cotton and in the curing, fermentation, and preparation of tobacco for the market. Approved varieties of tobacco and cotton seed are distributed amongst farmers and advice given to them personally and by correspondence and publications.

Chief of Division: W. M. Scherffius. Tobacco Warehouse Expert: T. E. Elgin. Expert for Turkish tobacco, Western Province, Cape: L. M. Stella, "La Motte," Paarl. Manager, Experiment Station, Rustenburg: H. W. Taylor. Manager, Experiment Station, Barberton: W. B. Wilson. Manager, Tzaneen Estate: E. H. F. Powell. Manager, Experiment Station, Piet Retief: R. Falgate. Manager, Cotton Experiment Station, East London: D. D. Brown.

DIVISION OF DAIRYING.

This Division deals with all matters connected with the advancement of dairying. The Division also controls the Cold Stores at Vryburg.

Superintendent of Dairying: E. O. Challis. Senior Inspector:................................ Instructors: *Cape Province.*—T. R. Carruthers, Government Offices, Parliament Street, Capetown, and C. Schnolke, Queenstown. *Orange Free State.*—W. Oosterlaak, Government Buildings, Bloemfontein. *Natal.*—............................, Colonial Office, Pietermaritzburg. *Transvaal.*—L. J. Veenstra, Department of Agriculture, Pretoria.

DIVISION OF HORTICULTURE.

This Division advises farmers on the growing and marketing of fruit, including table grapes and raisin drying, and grades fruit for export.

Chief of Division: R. A. Davis. Horticulturist in charge of Experiment Station, Warmbaths: C. A. Simmonds. Horticulturist in charge of Experiment Station, Ermelo: R. le Sueur. Instructor in Horticulture, Cape Province: S. W. van Niekerk, Bovenvallei, Wellington.

DIVISION OF VITICULTURE.

This Division is charged with the duty of advising farmers in all matters relating to the culture of the vine (excluding table grapes and raisin-making) and the manufacture of wine and brandy, and vinegar. It conducts field investigations into the suitability of various stocks, the use of fertilizers, modes of cultivation, etc., and investigates the diseases of the vine, and conducts both cellar and laboratory experiments in the making of wine and brandy. It examines pathological specimens and furnishes reports thereon, and examines chemically and bacteriologically specimens of the products above mentioned with a view to furnishing advice thereon to farmers.

This Division also includes the Government Wine Farm, Groot Constantia, where advice can be obtained by residents in the Wynberg and Hout Bay areas.

Government Viticulturist: A. J. Perold, Œnological Station, Paarl, Cape Province. Manager, Government Wine Farm, Groot Constantia: T. L. Watermeyer.

OFFICE OF GUANO ISLANDS.

This office undertakes the conservation, collection, shipment, and sale to the public of the guano, seal skins, etc., obtained on the various islands belonging to the Union, and is charged with the administration of all matters connected therewith.

Superintendent: W. R. R. Zeederberg, 69 Strand Street, Capetown.

DIVISION OF CO-OPERATION.

This Division is engaged in promoting co-operation for the sale and purchase of agricultural products and necessities amongst farmers and in organizing and supervising co-operative societies.

Superintendent: C. H. Keet. Chief Inspector: J. Retief. Assistant Inspectors: J. T. Taylor and H. Minnaar.

DIVISION OF CHEMISTRY.

This Division investigates problems of general or special importance, and for the present undertakes the analysis of soils, manures, and foodstuffs for farmers in the Transvaal, the analysis of similar matters in the other Provinces being undertaken in the laboratories of the Department of the Interior at Capetown, Grahamstown, Maritzburg, and Bloemfontein, pending the enlargement of the chemical laboratories at the agricultural schools and experiment stations.

The analyses are conducted solely for the enlightenment of the farmers and not for legal purposes.

Chemist: H. J. Vipond. Laboratory Assistant: L. Bischoff.

DIVISION OF FENCING AND BRANDS.

This Division administers the laws relating to fencing and brands, and publishes the Brands Directory, required by the Transvaal Act.

Controller of Fencing and Registrar of Brands: W. J. Nussey.

OFFICE OF HOUSEHOLD SCIENCE.

The duties of this office are to promote the study of household science by means of lectures, demonstrations, and correspondence.

Lecturer and Instructor: Miss J. C. van Duyn.

DIVISION OF DRY-LAND FARMING.

This Division conducts experiments and disseminates information on dry-land farming. An Experiment Station is maintained at Lichtenburg, with subsidiary ones at Pretoria, Warmbaths, and Pietersburg. Experiments in dry-farming are also conducted at the agricultural schools and experiment stations, and at other centres.

Dry-land Agronomist and Manager, Experiment Station, Lichtenburg: H. S. du Toit.

DIVISION OF GRAIN INSPECTION.

This Division undertakes the grading of grain at the ports prior to export, and, if requested to do so, determines the amount of moisture present in grain intended for export.

Chief Inspector of Grain: G. F. Nussey. Government graders are stationed at the docks at Capetown, Port Elizabeth, East London, and Durban.

DIVISION OF PUBLICATIONS.

This Division edits the *Agricultural Journal* and other departmental publications.

Editor: Dr. W. Macdonald.

LIBRARY.

The object of the Library is to provide as complete a collection of agricultural literature as possible for the purpose of reference.

Librarian: P. Ribbink.

AGRICULTURAL SCHOOLS AND EXPERIMENT STATIONS.

The duties of these institutions are to provide complete courses of education extending over a period of two years and shorter courses of a technical character for persons actually engaged in farming, to instruct farmers in the area served by them on matters relating to the various phases of farming by means of personal visits, lectures, demonstrations, and correspondence. To conduct experiments, to analyse soils, manures, dairy products, etc., and to identify plants and insects and test seeds. A certain amount of pure-bred stock and of new and approved varieties of seeds are produced on the farms and disposed of to the public.

The institutions do not undertake the administration of laws relating to agriculture.

Elsenburg School of Agriculture and Experiment Station.—Station: Mulder's Vlei; distance, 1½ miles.

Sub-stations at Malmesbury and Robertson.

Principal	Dr. A. I. Perold.
Lecturer in Veterinary Science	R. Paine.
„ Horticulture	L. Tribolet.
„ Chemistry	D. C. Crawford.
„ Engineering	W. H. Chandler.
„ Botany and Plant Breeding	J. H. Neethling.
„ Dairying	J. Gow.
„ Agriculture	F. Fowlie.
Farm Manager	Vacant.
Agricultural Assistant	C. L. R. de Wet, George.

Grootfontein School of Agriculture and Experiment Station.—Station: Middelburg, Cape Province; distance, 2 miles.

Principal	R. W. Thornton.
Lecturer in Agriculture	G. J. Bosman.
„ Veterinary Science	J. A. Robinson.
„ Engineering	E. A. Morris.
„ Chemistry	W. R. S. Ladell.
„ Zoology and Entomology	R. O. Wahl.
„ Dairying	J. Anderson.
„ Sheep and Goats	E. N. C. Warren.
„ Poultry	A. Little.
„ Farm Manager	Van der Merwe.

Agricultural Assistants: J. Meldal Johnson, Humansdorp; A. K. Hards, Cathcart; W. J. Lamont, Grootfontein; and Mr. Melle, Vryburg.

Cedara School of Agriculture and Experiment Station.—Station: Cedara, on farm; sub-station at Winklespruit.

Principal	E. Harrison.
Lecturer in Chemistry	C. Williams.
„ Biology	J. Fisher.
„ Veterinary Science	F. J. Curless.
„ Dairying and Poultry	A. Lawrence.
„ Horticulture	C. R. Parsons.
Farm Manager	W. C. Mitchell.

Potchefstroom School of Agriculture and Experiment Station.—Station: Potchefstroom; distance, 1½ miles.

Principal...	E. J. Macmillan.
Vice-Principal ...	H. Thompson.
Lecturer in Chemistry ...	T. G Reinecke.
„ Botany ...	T. O. Bell.
„ Zoology and Entomology...	W. Moore.
„ Veterinary Science	J. R. Quinlan.
„ Engineering	W. S. H. Cleghorne.
„ Poultry ...	R. Bourlay.
„ Horticulture	W. Sturm.
„ Dairying ...	J. B. Fisher.
„ Agriculture	A. M. Bosman.
Farm Manager ...	Alex. Reid.

STUD FARMS.

At these farms pure-bred animals, mainly horses, are maintained and bred for lease and sale to farmers.

Standerton Stud Farm.—Station: Standerton; distance, 11 miles. General Manager: A. McNae.

Tweespruit Stud Farm.—Station: Tweespruit, on farm. Manager: J. J. Morton.

GOVERNMENT WINE FARM, GROOT CONSTANTIA.

VISITORS' DAYS.

It is notified by the Secretary for Agriculture that it has been decided that persons shall be allowed to visit the Government Wine Farm at Groot Constantia between the hours of 9 a.m. and 5 p.m. on Mondays, Tuesdays, and Thursdays.

Export of Fruit.

THE following return shows the declared value of fresh fruit exported oversea from the Union of South Africa during the months of November and December, 1912, distinguishing port of shipment:—

NOVEMBER.

Description.	Via Capetown.	Via Port Elizabeth.	Via East London.	Via Durban.	Via Delagoa Bay.	TOTAL.
	£	£	£	£	£	£
Apples	3	—	—	—	—	3
Bananas	41	—	1	32	—	74
Grapes	—	—	—	—	—	—
Lemons	24	—	—	13	—	37
Naartjes	2	9	1	28	—	40
Oranges	118	12	18	60	—	208
Pines	35	8	4	27	—	74
All other	22	—	1	64	—	87
TOTAL ... £	245	29	25	254	—	523

DECEMBER.

Description.	Via Capetown	Via Port Elizabeth.	Via East London.	Via Durban.	Via Delagoa Bay.	TOTAL.
	£	£	£	£	£	£
Apples	4	—	—	8	—	12
Apricots	224	—	—	—	—	224
Bananas	16	—	1	17	—	34
Grapes	—	—		—	—	—
Lemons	16	—	—	1	—	17
Naartjes	—	7	—	2	—	9
Oranges	52	17	—	35	—	104
Peaches	32	—	—	—	—	32
Pines	41	10	2	21	—	74
Pears	15	—		—	—	15
Other kinds	19	1	—	12	—	62
TOTAL ... £	419	35	3	126		583

NOTE.—The above return does not include exports by rail to Portuguese East Africa and the Belgian Congo.

Statistical and Audit Office,
27th January, 1913.

Important Amendments to Codling-moth Regulations.

The attention of fruit growers, fruit shippers, fruit dealers, and of the public in general is invited to the recently amended regulations prohibiting the removal of apples, pears, and quinces in their fresh state into certain areas of the Union. These regulations will be published shortly in pamphlet form and in a subsequent issue of the *Agricultural Journal* in connection with regulations bearing on the removal of vines, grapes, and mango trees. With respect to these other articles the new regulations are identical with regulations published under the proclamation (No. 38 of 1912) which the present proclamation supersedes, while the change with respect to apples, pears, and quinces is that of omitting a number of districts from the area of the Cape Province into which the removal of these fruits has been prohibited for the past seven years.

The districts omitted from the protection given by the former regulations are Wodehouse, Queenstown, Tarka, Cathcart, Glen Grey, Stutterheim, Kingwilliamstown, East London, Victoria East, Fort Beaufort, Stockenstroom, Bedford, and Albany. In consequence apples, pears, and quinces may now be railed from any railway station in the Union to East London, Kingwilliamstown, Cathcart, Queenstown, Grahamstown, Adelaide, Fort Beaufort, and Tarkastad, but great care is necessary to avoid the removal of prohibited fruit into the portions of the Union that remain "protected." Every wrongful removal that comes to the notice of the Department of Agriculture is reported to the Magistrate of the district in which the offence took place, and he is urged to have the offending party prosecuted. The consignor and consignee may both be found guilty irrespective of negligence on the part of railway servants by failing to refuse to accept the fruit; and convictions are not infrequent.

The "protected" territory of the Cape Province now consists of two independent areas. One (*a*) comprises the Districts of Barkly East and Komgha and the Transkeian Territories from the Kei River to the Natal border, and the other (*b*) the Districts of Alexandria, Bathurst, and Peddie. The protected territory in the other Provinces remains unaltered, and consists of a single extensive area (*c*) which will be best understood by reference to a railway map in conjunction with the list of railways given below.

By virtue of the regulations the removal of apples, pears, and quinces in their fresh state *to* any place on any one of the below-listed sections of railway *from* any place on any other section of railway is prohibited, save that removals are allowed (other than from Standerton) between points on any two of the several sections listed in (*c*) area :—

(*a*) **Area (removals from one section to other not allowed):**
Sterkstroom-Maclear branch east of Indwe.
Amabele-Butterworth branch.

(*b*) Area (removals from one section to other not allowed):
Kowie railway.
Alexandria branch.

(*c*) Area (removals from one station to any other allowed):
Midland main line, Roodewal (Orange Free State) to Klip River (Transvaal Province).
Western main line, Kingswood to Bank.
South-Eastern line, Mapleton (Transvaal Province) to Cedara (Natal).
Eastern main line, Belfast to Airlie.
Standerton-Vrede branch throughout.
Johannesburg-Viljoens Drift line, Grasmere to Viljoens Drift.
Krugersdorp-Mafeking line, Tarlton to Buurmans Drift.
Lichtenburg and Delarey branches throughout.
Johannesburg-Breyten line, Endicott to Breyten.
Machadodorp-Ermelo-Piet Retief line throughout.
Lydenburg branch throughout.
Komatipoort-Tzaneen branch, Newington to Mica.
Parys branch throughout.
Heilbron branch throughout.
Ladysmith-Bethlehem line, Aberfeldy to Swinburne.
Bethlehem-Kroonstad line, Lovat to Vijfhoek.
Maritzburg-Malenge Valley branch, Elandskop to Franklin, but excluding Elandskop Station.
Greytown branch, Cramond to Greytown.
Utrecht branch throughout.
Vryheid branch throughout.
Upper Tugela branch throughout.
Richmond branch throughout.
Weenen branch throughout.
Stuartstown branch throughout.
Howick branch throughout.
Mid Illovo branch, Mid Illovo Station.

Removals from (*a*) area to (*c*) area are allowed where these two areas are in contact (Cape-Natal border); but with this exception, removals are not allowed from one protected area into another.

Removals from Standerton and Meyerville, adjoining townships in (*c*) area, are especially prohibited, and this prohibition does not annul the general prohibition on the removal of fruit to these towns from any place outside of (*c*) area.

The removal of boxes, etc., that have been used for the storage or conveyance of apples, pears, and quinces into areas into which the removal of these fruits is prohibited is contrary to regulations published under Government Notice No. 366 of 1912. Hence the return into a protected area of boxes, etc., that have been used for the conveyance of any of the fruits named to any place outside of that area is not allowed. It also follows that it is illegal to use second-hand apple barrels, apple boxes, pear boxes, etc., for the sending of any produce whatever into a protected area.

Fruit growers of the Bathurst District are specially cautioned against having any boxes, etc., in which they send apples or pears to Grahamstown returned to them. Fruit growers of the Komgha

District are similarly cautioned with respect to apples and pear boxes which they send to East London or Kingwilliamstown.

Travellers by train and cart are cautioned that the regulations apply to removals by any means whatever. A passenger would be violating the restrictions if he took any prohibited fruit away from a train within a protected area.

The removal of the restricted articles *through* a protected area in direct transit by rail or post from a place outside of it to a place outside of it is allowed. It follows that passengers for Johannesburg or Pretoria from Capetown or Durban, or vice versa, may take the fruits concerned with them, and that the fruits may legally be taken by railway dining-cars running between points not in protected areas and passing en route through a protected area.

The object of the regulations is to check the spread of the codling-moth into parts of the Union which are still supposed to be free of this pest and which are supposed to be generally suitable for the culture of apples or pears. The contraction of the protected Cape area brought about by the new regulations was prompted by the presence of the pest in many places within the part now omitted from the area. The presence of the pest to a very small extent is suspected at a number of places within the still protected areas; and, as a check on its spread from sources within, regulations under Government Notice No. 366 of 1912 prohibit in the protected areas any person to

"(*a*) expose or offer for sale or keep in stock for sale or exchange or give or remove from the property where grown any fruit which he knows to be or to have been infested at any time with codling-moth;

"(*b*) remove or cause to be removed from one property to another any living egg, larva, pupa, or imago of the codling-moth, or any fruit of any kind which he knows to contain or to have contained at any time codling-moth;

"provided that the department (Agricultural) may specially authorize the removal and disposal of such fruit, and provided further that any person may forward to the department securely packed specimens of the codling-moth or fruit which contains that insect."

The effectiveness of these various measures in retarding the spread of the codling-moth will depend to a very great extent on the alertness of parties within the protected regions in detecting and reporting infringements. In its destructive stage the insect is a flesh-coloured or pinkish, practically hairless, dark-headed caterpillar, which when full grown is about five-eighths of an inch long. It tunnels in definite channels through the fruit, usually from the blossom end or from a point of contact with another fruit or other body, and a mass of brownish pellets of rejected matter generally projects from the burrow. The dark-headed, definite legs, and ability to spin a silken thread readily distinguishes it from the headless and legless fruit-fly maggot that is often found in numbers in fruits of various kinds. Any party who may discover codling moth in any orchard, garden, market, shop, or other place in a protected area is earnestly requested to report the matter at once to the local police or—what is better—to the local Magistrate. Similarly, any introduction of apple, pear, or quince fruits from outside the area should be reported without delay.

The co-operation of fruit growers, fruit dealers, market agents, and market masters with Government officials in rendering the regulations effective is specially desired. Where it gets thoroughly established the pest may attack and destroy or seriously injure nearly every apple and pear if the troublesome measure of thoroughly spraying the trees with an arsenical poison is not practised. Specialists in fruit culture who have experience with the pest do not, as a rule, find it a grave obstacle to success in their business, since they are easily able to employ remedies in the most approved manner; but parties to whom fruit growing is subordinate to other interests, especially those who have high trees, are apt to deem remedies too laborious for their adoption or to employ them in an inefficient manner. Many would rather sacrifice their trees than take the trouble to combat the pest. The parent moth is able to fly several miles, and hence the pest tends to spread over the country, but the spread from place to place is chiefly effected by means of infected fruit or fruit boxes in which the insect has secreted itself.

Fruit growers resident in the protected areas should bear in mind that these regulations are imposed for their special benefit, that is to retard the spread of the pest to their orchards, and it is expected that in self-interest they do all in their power to render the regulations effective. They themselves will be liable to the full penalty provided if they allow any codling-moth affected fruits to be removed from their premises, and likewise if they bring back to their premises any boxes or bags (new or old) in which apples, pears, or quinces have been sent to any point outside of the closed area; and this is true whether the articles are brought back by train or wagon.

Residents on uninfested farms in parts of the country where unrestricted traffic in apples, etc., is being allowed to continue are advised strongly to avoid bringing any infested fruit or old fruit boxes on to their farms. It is considered impracticable to help them to protect themselves by Government regulations, but their own vigilance may long serve to keep the insect away. Apples, pears, or quinces from any place should be regarded with suspicion.

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Editorial Notes.

The Editor's Visit to the Old Country.

Dr. William Macdonald, the Editor of the *Journal*, sailed for England on the 26th March on six months' leave.

Although Dr. Macdonald nominally proceeds on vacation, he will combine business with pleasure; in other words, he will be ever on the lookout for new ideas and new facts likely to interest the farmers of South Africa, and readers will look forward to the wealth of valuable matter which he is sure to bring back with him.

Whilst in England and Scotland, Dr. Macdonald will deliver a number of lectures on South Africa illustrating what has been done here and the possibilities of this country for farming and the investment of capital in farming ventures.

By the time these lines fall under the eyes of our readers, Dr. Macdonald will be nearing the shores of the Old Country, and we are sure his many friends on this side will join with us in wishing him a pleasant and successful sojourn in Great Britain.

Winter and Veld Fires.

Winter, the dry season of the year outside the Western Province of the Cape, the season of veld fires, is steadily approaching. In a few weeks the veld fires will begin, and the nights will be rendered lovely by the ribbons of fire creeping steadily over the hillsides. The firing of the veld is a time-honoured custom in South Africa, and dates from the first days of great, poorly stocked farms when, as is still sometimes the case, holdings were beyond the capacity of the limited number of stock they carried to keep the grass short; and as the grass shot up in the late summer months and dried out into coarse, unpalatable herbage, it was necessary either to mow it or burn it off to provide for succulent young shoots for the impoverished stock

in the spring. Mowing was quite out of the question over the extensive areas that had to be disposed of; burning was cheap, rapid, and immediately as satisfactory. The ultimate effects were not contemplated in the grim struggle for existence. On a considerably reduced scale the same conditions are still to be found in parts of the Union. The circumstances cannot be overlooked by the opponent of veld-burning, nor can he justly blame those who practise this mode of ridding their farms of the coarse, last-season's grass. It is not in human nature to suffer present loss for future gain unless the loss is incomparable with the gain—unless the present inconvenience can be tided over by other means. And that is just the trouble with many of our farmers. Veld-burning is often necessary to prevent losses in the spring—losses which might cripple their farming operations in the future, besides almost wiping out an important source of farm revenue. We know of cases where the abandonment of veld-firing would simply spell disaster—cases in which the farmer recognizes the ultimate evils of grassburning, yet is bound to continue the practice until such time as he can make other provision. But this we must recognize, too, namely, that the practice of veld-firing is more extensive than its necessity. As we have said, it is an easy and a cheap means of ridding the veld of the coarse, mature herbage of the previous summer and of making room for the succulent young green grass in the forthcoming spring. And because it is cheap and easy, its practice is regrettably widespread.

But why, it may be asked—why trouble about the matter at all? Indeed, why not encourage it? It is a rapid means of providing young grass; provided the rains are not over we can, by burning a patch here and there at intervals, whenever the grass is dry enough to burn, secure a succession of green fields of succulent feed, and this makes for the development of stock farming: at least, it makes farming easier. Then, why trouble?

The Parellel of Crop Production.

Why? Because veld-burning is not good farming. It is short-sighted farming. It is farming for the present and letting the future take care of itself. We all know the trouble with new countries in regard to crop production. We know that the natural tendency is to live for the present—the present that is giving us good yields at a minimum of expense—and in a hazy kind of way we feel that the fertility of the ground will last out as long as we shall. And if it does not, the remedy is simple: land is cheap—we sell out and buy another farm with virgin soil. Such manuring as we do is for the present only—from season to season. We use artificials if we use anything, but the real fertility of the soil, that wonderful sustaining and responsive power which the soil has when it is properly worked and cared for, is left to the shadowy future settler to take in hand. For the present it is unnecessary; we are making our pile—why trouble about the future?

Man is admittedly not philanthropical. He lives for himself first. If he gives, he gives of his surplus, he parts with what he can comfortably spare; if he works without hope of material reward for others, it is after he has worked to satisfy his own wants. And in

the case of soil deterioration in new countries, the same law applies. The farmer, as a business man and a human being, works for himself, for his immediate needs first. He goes on wearing out the land and seeking new, and only when the pressure of economic laws is felt, when the influx of settlers and the consequent increasing value of land makes his own holding valuable and the obtaining of new land more and more difficult, does he change his methods and trouble about the real fertility of his soil. And when he takes that question in hand he has commenced to build for the future. The present may yield him less, but the future is safe. He is beginning to build up one of those farms that yield for centuries, such as we find in England, on the continent of Europe, and, on a steadily increasing scale, in the United States.

The Evils of Veld-burning.

In the case of veld-burning, the trouble is the same. When land was cheap and large farms were more the rule even than they are now, the burning of the veld each autumn or winter offered an easy solution of the difficulty of getting rid of the season's growth of grass become coarse during the months that follow on after the early summer. The practice is still followed in many parts of the country—more extensively than it should be, although, as we have said, there are cases where the farmer cannot well do otherwise, young settlers, particularly, who cannot yet launch out to a sufficient extent to render its practice unnecessary. Where we cannot do otherwise than live for the present—struggle for existence by whatever legitimate means—there is nothing to be done but look forward to the time when that struggle will not be such a terribly earnest one; but where the wants of the present are not so insistent, we should look ahead and seriously contemplate the evils of the system we are following. The future is the consequence of the present; that is a fact which we may blink but which is none the less true. As we sow, so shall we reap; and it surely behoves us to look to our sowing in order to make our future more comfortable, more prosperous.

What, then, are the evils of grass-burning? We have said that the periodical burning of the veld is bad farming. How is the practice going to affect us in the future? There is one great evil connected with the system which very closely concerns the stock farmer: that is the coarsening of the grasses of which the veld is composed. Good veld, well cropped by stock but not overcrowded, and untouched by fire, comprises a number of species of grasses: fine, nutritious kinds, and coarser and less palatable sorts. Burn off your veld every year and you gradually kill out all the best and finest species, reducing it to a few kinds of coarse, relatively innutritious varieties. These latter, being stronger, are able to withstand the annual shock of fire where the finer kinds go under, with the inevitable result, after a term of years of firing, that you lessen the stock-carrying capacity of your veld. That capacity is small enough as it is, and instead of lowering it by annually burning off the veld, the progressive farmer rather endeavours to increase it by the laying down of permanent pastures of the most nutritious kinds of imported grasses that will thrive in his district.

Intensive Farming in Germany.

It is a fact well supported by common observation that extensive farming is the rule in the new country, intensive farming in the old. A scattered population is conducive to large farms, and large farms naturally do not tend to intensive cultivation. Increase the population, however, and the demand for land goes up, and its price at the same time. Large holdings tend to get divided up, for the relatively high price of land on the one hand induces, especially when times are not too prosperous, the original land holder to sell, whilst on the other it debars the settler from acquiring a considerable holding; and the force of circumstances obliges him to make the soil yield the utmost that his skill and knowledge can extract. Indeed, one might fitly remark: "Tell me the size of your holding, and I will tell you the stage in economic history which your country has reached." Germany is undoubtedly the home and example of intensive culture. What the practice of intensive farming has done for that country is well demonstrated in an interesting article from the pen of Professor Homer C. Price, Dean of the College of Agriculture at the Ohio State University. Professor Price quotes figures to show that the average yield per acre of wheat during the period 1886-1895 was 21.2 bushels: in the period 1906-1910 it was 31.2 bushels, an increase of 47.8 per cent. in twenty years. The increase in the case of rye was even greater—from 16.6 to 28.3 bushels, or 70 per cent. The average yield of oats increased from 34.1 to 57.5 bushels (68.6 per cent.); of barley, from 24.5 to 37.2 bushels (51.8 per cent); and of potatoes, from 130 to 210.1 bushels (61.6 per cent.). In the United States the percentage of increase has in each case been much smaller, thus justifying the author's conclusion that the German farmer is not only producing much more on the same area, but that he is increasing his yield much more rapidly than is the American farmer. And yet, observe, the German farmer has not reached his limit by any means; one of the leading German agricultural authorities, Professor Wohltmann, said recently that he was confident the German farmers could increase their present yields by 40 per cent. during the next twenty years.

Why the German Farmer has succeeded.

The ultimate reasons why the German farmer should have made such notable advances in intensive farming would probably have to be sought in a comparative study of national temperament and of economics; but the more immediate and practical reason is a matter of the amount of capital and labour and thought expended upon each acre of land. The German farmer prepares his fields so that they look like a garden, and he sees that his soil is in fine condition before he plants his crop. He exercises great care in the selection of his seed, and aims at as perfect a stand as possible. He has learned how to fertilize his crops, and for this purpose he saves every bit of waste on his farm and returns it to the land. He carefully preserves his stable manures and then generously supplements them with commercial fertilizers. He knows, moreover, how to use commercial fertilizers, and one great lesson he has learned, a lesson that every

good farmer learns, is that they are not to be used to replace stable manure, but to supplement it. He knows the value of humus, and his land is easy to cultivate and will hold rain water that falls on it: it is neither too sandy on the one hand nor too clayey on the other. To add humus to his soil, he grows leguminous crops and ploughs them under, and he applies stable manure also.

But at the back of all this, as Professor Price points out, are two great causes. In the first place, due account must be taken of the active and effective work that the German Government has done to develop agriculture, in pursuance of the policy of all the European nations, namely, to be in a position to produce their own food supply in case of war. An excellent system of agricultural education has been developed and an extensive scheme of scientific research through agricultural experiment stations is maintained. Chambers of agriculture have also been established, and these are doing a great amount of good. We read that these chambers not only look after ordinary administrative matters, such as the enforcement of inspection laws, but they are actively engaged in promoting the business interests of farmers through the organizing of co-operative societies. The second great factor in the evolution of intensive farming in Germany has been the introduction of co-operative principles, resulting in an efficient business organization. In regard to credit particularly has this been the case. The development of intensive farming calls for an abundant expenditure of working capital, and what has happened in Germany? "German farmers," says Professor Price, "through their land mortgage associations, are carrying at the present time over one billion dollars [equivalent to 200 million pounds sterling] in farm loans, and they do not pay over 4 per cent. interest for any of it, and in many cases not over 3 per cent." It is interesting to note that there are also over 16,000 rural banks in Germany that are co-operative farmers' organizations, owned and operated by the farmers, and having deposits of £50,000,000. Through these institutions the German farmer is able to secure loans for working capital on as favourable terms as are secured by any industrial class. The length of time for which the loan is made and the terms of repayment are adjusted to meet the requirements of agriculture.

South Africa and Closer Settlement.

What are the conclusions to be drawn from a study of these considerations? Four main factors have operated to bring about the upliftment of German agriculture from relatively extensive to relatively intensive methods. These are: (1) Economic pressure; (2) agricultural education and scientific research; (3) credit facilities; and (4) the driving energy of the farmer himself. Let us give a little consideration to each of these four factors and see how South Africa stands in relation to them. We have, in the first place, the factor of economic pressure. How it operates in regard to the settlement of the land we have seen; and we may at the present time witness its workings in some of their many stages without going beyond the shores of South Africa. Here we find farms of all sizes, whose acres may be numbered in many thousands, in hundreds, and in dozens. We find the price of land ranging within extraordinary extremes: it is a matter of demand, which in turn arises from the influx of settlers

from other districts or other countries, and this again is due to the suitability of the locality for some particular class of farming.

The economic conditions which have sprung into existence at Oudtshoorn, along the Natal coast, and elsewhere will be duplicated in time in other parts of the Union—not in regard necessarily to the same branches of farming, but in regard to all branches. Certain classes of farming in certain conditions naturally yield higher returns than do others, and it is these which are first sought when a country has become settled. As time goes on, the less remunerative classes of farming are taken up more extensively; and the gradual rise in the price of land due to the increasing population reduces the average size of the ordinary holding and renders the adoption of increasingly intensive methods a matter of sheer necessity.

The second of the four main factors which make for agricultural progress is agricultural education and scientific research. Here in South Africa the need for these two forms of activity is fully recognized, and is provided for by the State. Moreover, it is pleasing to note that our farmers are more and more seeking the advice of the various experts of the Department of Agriculture and realizing better the value to them of the Department; whilst the maintenance of schools of agriculture by the Government is a most popular institution. In regard to credit facilities, too, the State is assisting the farmer, through the Land Bank. The fourth factor is the farmer himself. There are farmers and farmers, the outcome, principally, of heredity, environment, and economic conditions; and the many stages between indolence and *laisser-faire* at the one extreme, and driving energy and capacity and willingness for hard work at the other, are to be observed in the farming community of the Union to-day. Indeed, it would be safe to lay down as a general rule, with notable exceptions, that these stages are concurrent with the sizes of holdings, from indifference and large farms on the one hand to hard work and small holdings on the other. But, as we have said, there are notable exceptions, where men owning large farms are honestly hard-working, striving always to develop their holdings to the fullest possible extent. These exceptions, however, are relatively few in number. The general rule is as we have stated; nor can the owner of a large holding be altogether blamed if he fails to develop it to the fullest extent of which his knowledge of farming is capable. After all, the main driving force behind human industry is the securing of the wherewithal to live, and if a man be content with a modest income he is not altogether to be blamed if he fails to work to secure a greater one. But the main point is this: that the sub-division of land that necessarily follows upon settlement and which increases with the growth of population tends to increase the sum-total of human industry. In other words, as farms become smaller, as a general rule farmers are forced to work harder.

We find, then, that, so far removed as we may be from the close-settlement conditions which prevail in Germany and other European countries to-day, we nevertheless have all the elements necessary for the production of a like condition of things in South Africa in years to come. Agricultural research, agricultural education, and the settlement of land: these are the three things the prosecution of which must in due course result in a South Africa supported by the products of the soil.

The Union's Trade in 1912.

A satisfactory balance of trade is reflected by the Union Customs returns for 1912. Our exports increased by over six millions sterling over those for 1911—from £55,389,353 to £61,594,113—and our gross imports (merchandise) amounted to £36,009,841, as compared with £34,945,447, the net imports (i.e. after deducting the value of imported goods re-exported) being £34,629,735 in 1912, as against £33,310,800 in 1911. Subtracting net imports from exports, we thus had a balance in our favour of £26,204,378 last year, as compared with £22,078,553 in the previous twelve months. Raw gold was responsible for over thirty-eight millions sterling of the income of the country in 1912 and for thirty-five millions in 1911, which means that, were it not for this commodity, the balance of trade would be on the wrong side to the extent of over eleven millions (on the basis of the 1912 figures). The lesson to be drawn from this is that our efforts to increase the agricultural output of the country must be unceasing, the ideal to be aimed at being a position in which the country's imports are paid for by the products of the farm. In this connection a glance at the exports of farm products during 1912 and 1911 will be of interest. A comparative list of these is given in the following table:—

Exports of Farm Products.

	1912.	1911.
Animals, living	£30,988	£45,388
Bark	283,010	289,556
Feathers, ostrich...	2,609,638	2,253,140
Fodder and forage	44,422	29,124
Dairy produce	2,729	1,243
Coffee	1,076	2,379
Corn, grain, and meal...	564,607	472,917
Eggs	7,074	5,418
Fruit, fresh	54,735	45,572
Fruit dried and preserved	1,387	4,386
Meats	11,533	7,269
Lard	4	—
Spirits, potable	2,725	3,365
Spirits, non-potable	28	15
Sugar	4,292	2,665
Sugar products	13,597	11,617
Tea	313	2,355
Vegetables	21,044	15,020
Wines	12,728	13,865
Hair, Angora	967,286	917,874
Hides, ox and cow	670,887	370,548
Skins, sheep and goat	1,015,891	837,093
Horns, ox and cow	13,605	10,679
Tobacco	12,373	8,882
Calabashes (tobacconists' wares) ...	27,815	26,647
Wool	4,780,594	3,899,828
	£11,154,381	£9,256,825

As illustrating how the exports of farm products are increasing, it may be mentioned that the shipment oversea of the same commodities as those enumerated in the foregoing list brought into the country £9,512,100 in 1910 and £8,969,855 in 1909. The net imports have also increased in a slightly greater proportion, as the following figures show:—1909, £25,059,503; 1910, £32,592,533; 1911, £33,310,800; 1912, £34,692,735. Last year the export of farm products paid for about 32 per cent. of the value of the net imports.

Our Imports of Farm Products.

Over the last three or four years—possibly longer—this percentage has fluctuated but little, and in a new country whose backbone for the time being is a great gold mining industry the figure may be considered fair; but when we come to scrutinize our imports more closely we realize that this percentage could, and ought to, stand at a much higher figure. Consider, for example, the group "corn, grain, and flour." Last year the value of our imports under this head amounted to over a million sterling! The largest items were flour (£498,464) and wheat (£395,265). We bought £41,520 worth of beans and peas, £19,314 worth of dholl (lentils), £95,434 worth of malt; besides other smaller items, e.g. barley (£497), maize (£3885), oats (£3663). These imports should, and will eventually, all cease. Then, again, what are we to think of the fact that we imported butter to the value of £262,402? Moreover, in 1911 our imports were less—£192,987; in 1910 they amounted to £178,469; in 1909 they were valued at £216,421. Cheese, too, we are importing in considerable quantities; last year we bought over five million pounds weight, valued at £158,787. Here, again, instead of our imports diminishing they are increasing, as the following figures will show:—1909, £114,065; 1910, £133,531; 1911, £143,640; 1912, £158,787. These two products of the dairy alone furnish food for much serious reflection. Think of the scope for dairying in this country! Here is a market that will still absorb another £150,000 worth of cheese and butter to the value of a quarter of a million sterling every year, before we need turn to the oversea markets. These figures should be of little significance in a country the size of ours, but in a land whose crying need is for more farmers, and still more farmers, they are sums worth considering. If they only represent some seven or eight hundred farmers added to the rural population of the Union they nevertheless mean seven or eight hundred farmers of a most useful class, who will save the country practically half a million per annum and serve as an additional advertisement of the grand agricultural possibilities of South Africa. Take, now, the item fresh eggs. Our imports have increased from some £50,000 in 1909 and 1910 to close on £70,000 in 1912. Seriously considered, these figures are absurd. We know that, unless a business is made of poultry rearing pure and simple this branch of farming does not form a very considerable proportion of farm revenue. But we know that it is a side line well worth taking up, bringing much needed grist to many a mill. We know, too, the argument of many farmers that poultry do not pay. We admit it. Poultry do not pay—the way they are generally kept. But with ordinary care and intelligence they are a remunerative side line that many a farmer

ought to take up. We recall the case of the writer's younger brother, who took up farming on a 260-acre holding in the uplands of Natal in the middle of 1911. He took poultry with him and the farmers around laughed at him, saying that he was simply wasting time and money in trying to run poultry in that district. They would not thrive there. They themselves had tried them and failed. The young settler confidently tried them also, and succeeded, and now this line of farming is bringing him in quite a respectable little sum weekly, and he is going to launch out further. What will help more perhaps than anything in furthering this neglected industry is the formation of co-operative societies. We are glad to note that in the Cape Province a start is being made by Mr. A. Little, the Lecturer in Poultry at the Grootfontein School of Agriculture. Fort Beaufort is mentioned as likely to lead the way in the matter. The idea is to establish a depot near the station where the eggs will be received at stated times, the honorary graders testing them and subsequently grading them into three qualities according to shape, colour, size, texture of shell, etc. The eggs will be marked with the society's stamp and date as guarantee of quality. The secretary will watch the market and see to the packing of the eggs in specially constructed and ventilated boxes for transport by rail to the centre where the best prices are ruling at the time. Periodically the shareholders will divide the profits made, but the suppliers will also receive a bonus according to the number of eggs sent in during the months they are scarcest. An excellent example this, and one which we should like to see followed by farmers in other parts of the country.

Other Features of the Returns.

But we must pass on; there are other items among our imports to which we would like to draw attention. Our annual meat bill is larger than it should be. Last year it amounted to £478,345, of which £223,384 was spent in hams and bacon. Nor is this item on the decrease. In 1909 we imported £346,211 worth of meat, of which £195,059 was spent on bacon and hams. Last year we purchased from abroad £88,270 worth of beef, £25,450 worth of mutton, and £8757 worth of poultry (for table use). These are items that will have to be deleted from our Customs returns—the former two at least are unworthy of a country that possesses the great areas of grazing ground that South Africa boasts; the last item we have already dealt with. The amount we are spending on bacon and hams further demonstrates some of the possibilities of this country; linked with dairying swine husbandry has a good future. Other items which should at least be very considerably reduced are condensed milk (£424,460), potatoes (£10,587), dried fruit (£48,995), sugar (£464,941), golden syrup (£117,681), tea (£250,108), and tobacco (£17,535), to mention the most important.

There are, on the other hand, some pleasing features of the import returns. Included in the group, "living animals" are the values of breeding stock, and, whilst these are not shown separately, an examination of the totals for the group is of interest and serves as a guide to the progress which the live stock industries of this country are making. Here we find some interesting figures. In 1909 we imported

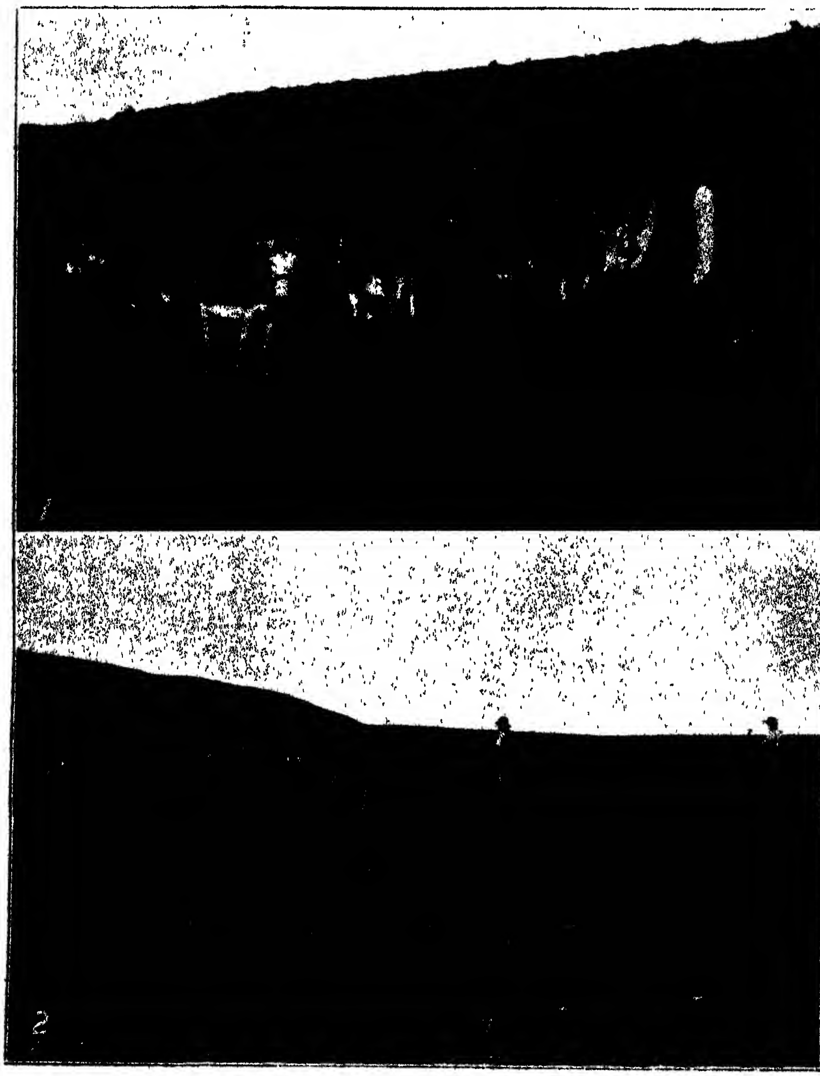


Plate No. XXXIX.

A Young Natal Settler.

1. Inspanning for the second shift (showing implement shed in background). 2. Hard at work. (The span requires no voorlooper, the leading pair turning at the headlands of their own accord and always going on to the last furrow on the other side of the strip.)

live stock to the value of £75,902; in 1910 the returns show the value of the imports to be £139,151; in 1911 this was £159,347; and last year £162,521 worth of live stock were imported—an increase of 114 per cent. over four years! The figures relating to the importation of agricultural machinery and fertilizers should indicate even more clearly the rise of a progressive spirit in our farming, and the increase observable under these two heads are noteworthy. In 1909 our imports of agricultural machinery were valued at £116,974; the following year they increased to £148,964; in 1911 they amounted to £196,417; last year we spent £221,092: constituting an increase of 89 per cent. in the four years. Again, with manures and fertilizers, we imported £68,549 worth in 1909; £91,841 worth in 1910; £102,724 worth in 1911; and £124,511 worth in 1912. The increase in this case was over 81 per cent. These increases not only indicate a more prosperous farming community, but they also point to the development of a more progressive spirit among our farmers.

A Young Settler with a Future.

In past issues of the *Journal* we have from time to time published pictures illustrative of the notable progress which relatively long-established farmers have made in various branches of farm industry. Such pictures as these serve as a stimulus to other farmers to emulate the successes of their confreres, whilst they further give some idea of the possibilities of farming in this country. This month we enable readers to glance at the other end of the line—the beginnings of a farm which has every indication of developing into a good proposition in the future. Our pictures portray the operations of a struggling beginner in the Besters district of Natal, a young man of about 23 years of age, who commenced farming in July, 1911. Born in Maritzburg, and of British descent, his original intention was to take up mechanical engineering, and in fact he studied for some time in England to that end with considerable success. On his return, however, a combination of circumstances decided him in favour of farming, and he bought a holding of 250 acres in the district referred to. His first step was to build a couple of rooms (of stone), which serve in the meantime as living rooms, but are destined for dairy purposes later, his idea being to develop his farm first and build a house later. With the exception of these rooms, all the buildings on the farm are of his own construction, and are built of green bricks, the outer walls being later coated twice with linseed oil in order to harden them. He uses donkeys for traction purposes, and for the present is going in for general crops (with maize as the staple), and is trying earthnuts, for which there is a good market in Durban. If these succeed in his district he intends to practise crop rotation more thoroughly than he can do at present. It is of interest to note that he started in 1911 with the new Mercer breed of maize, and took two or three second prizes at the last Royal Agricultural Show at Maritzburg in competition with older farmers, including the originator of the breed himself, and as a result he received an offer from a large Maritzburg firm of seedsmen for all his Mercer seed. This offer has been repeated for all the seed he produces this season. The seedsmen's report last year was that his seed was the best they had handled of the Mercer variety that season. Pigs and fowls are the only other stock on the farm at present, but he intends

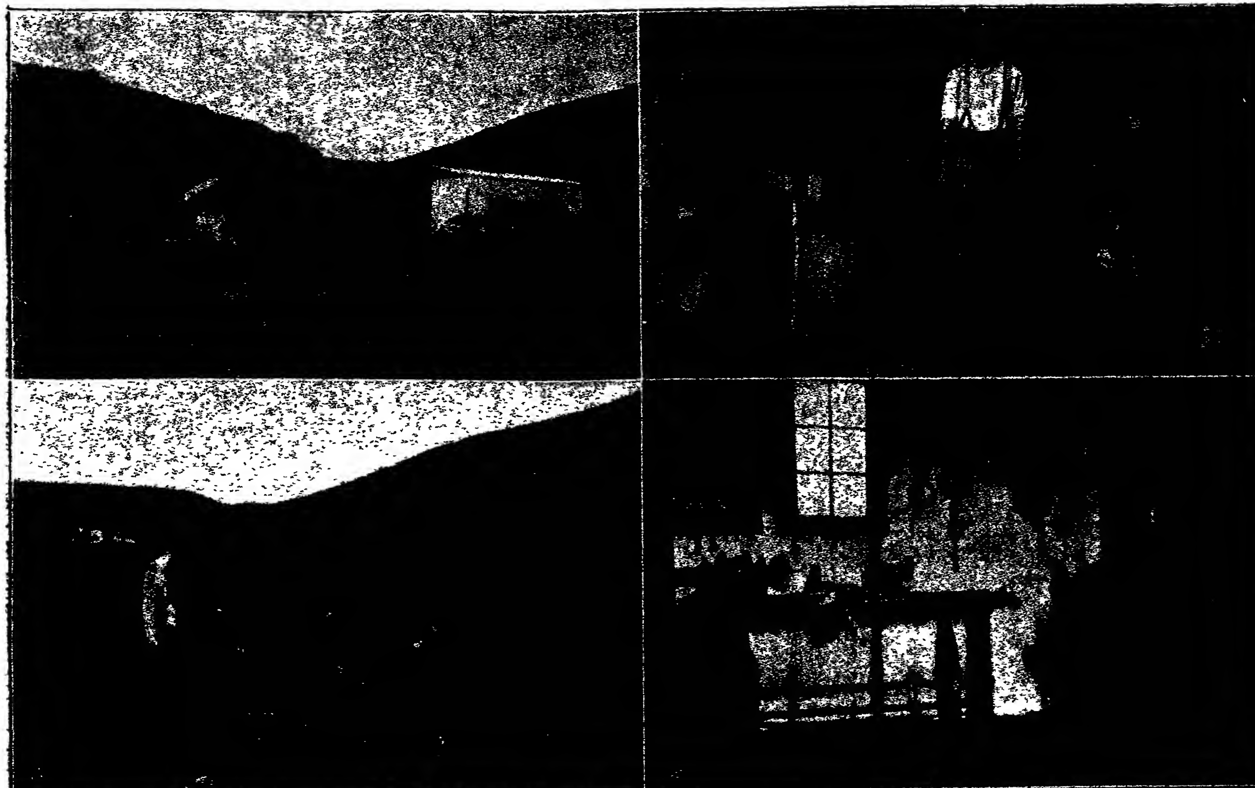


Plate No. XL.

A Young Natal Settler.

1. A Handy Home-made Cart. A large one is used for heavy work. (Portion of Poultry Runs in background.)
2. The Smithy. 3. The Piggery. 4. The Workshop.

going in for dairying later on. He has a small orchard planted, and is putting in forest trees whenever opportunity occurs. This young beginner in farming is a good example of a hard-working settler. He is up at four in the morning during the ploughing and planting season, and does most of the ploughing and all the planting himself. It will be interesting to watch the career of this young man. If untiring energy and unbounded confidence in his farm can bring him success then he has nothing to fear.

Humane Slaughtering of Animals.

Much attention has recently been directed to the methods adopted for the slaughtering of animals for food, and a strong case has been made out for reform in the methods at present in use. Hitherto the treatment of animals in public or private slaughter-houses has not attracted much attention, as it is a subject which has not appealed to the average refined taste. That, however, is an attitude which is regrettable, as the magnitude of the meat industry is such as to warrant very special control and regulation. The agitation in connection with humane slaughtering began about ten years ago, and it first of all resulted in the appointment of a committee by the Admiralty to inquire into the whole subject. This committee reported in 1904, and the following is a summary of the recommendations which they made:—

(*a*) All animals, without exception, must be stunned, or otherwise rendered unconscious, before blood is drawn.

(*b*) Animals awaiting slaughter must be so placed that they cannot see into the slaughter-house, and the doors of the latter must be kept closed whilst slaughtering is going on.

(*c*) The drainage of the slaughter-house must be so arranged that no blood or other refuse can flow out within sight or smell of animals awaiting slaughter, and no such refuse shall be deposited in proximity to the waiting pens.

(*d*) If more animals than one are being slaughtered in one slaughter-house at the same time they must not be within view of each other.

(*e*) None but licensed men shall be employed in or about slaughter-houses.

Since then the agitation has been continued, but none of these recommendations have been enforced. A great advance, however, has been made through the action of the Royal Society for the Prevention of Cruelty to Animals in perfecting humane slaughtering instruments and in giving public demonstrations so as to convince all those interested that these instruments are preferable to the traditional weapons generally in use.

In 1911 a Bill was introduced into the House of Commons, having for its object the regulation of slaughter-houses throughout the United Kingdom, but it was not proceeded with, and since then the Royal Society for the Prevention of Cruelty to Animals has carried on the work of education of the meat industry in this matter. At the beginning of 1912 a committee was formed, which fully investigated the various methods of slaughter by the modern humane instruments, and two demonstrations were arranged at Islington

abattoir, when the various weapons were used on cattle, sheep, and pigs. The general principle of all of these weapons is that a captive bolt is discharged with great force, either by means of a cartridge or a spring. The bolt penetrates the skull of the animal and instantly lacerates the brain, thus producing unconsciousness. Another form of weapon, however, is the Ransom Killer, which uses compressed air as the propelling force, and the development of this appliance is due to the enterprise of the Council of Justice to Animals, a society whose objects are somewhat similar to those of the Royal Society for the Prevention of Cruelty to Animals. Following upon these demonstrations, a similar demonstration was given in Edinburgh in February last by the Royal Society for the Prevention of Cruelty to Animals, when humane slaughtering instruments of all kinds were used on cattle, sheep, and pigs. The improvement of slaughtering methods is a matter which concerns every class of the community, and here in South Africa there is certainly room for improvement in abattoirs and slaughter-houses, public and private, if the recommendations of the Admiralty committee referred to above are taken as a basis.

The Month and the Magazines.

The English journals to hand refer to the great sale of Shires which took place at Lord Rothschild's stud-farm at Tring Park. The attendance at the sale was evidently a great and notable gathering, forming a redoubtable company of leaders in Shire horse-breeding. The sensation of the sale was undoubtedly provided by the two-year-old Champion's Goalkeeper, by Childwick Champion. The *Farmer and Stockbreeder* describes him as a "wonderful colt for weight, thickness, and power, while he moves above reproach." The opinion of the ring was evidenced by the bidding, which started at 1000 guineas, rising rapidly until 2000 guineas was reached. Then came a duel between Sir Walpole Greenwell and Mr. Gresson, of the Egcote Shorthorn Company. Rapidly 3000 guineas was reached, and then the bidding, rising by hundreds, gradually mounted to 4000 guineas, bid by Mr. Gresson. Sir Walpole responded with another hundred, but Mr. Gresson did not respond, and, after having been in the ring but a brief five minutes, the colt was knocked down to the former. This price constitutes a record. Tatton Dray King formerly held the record of 3700 guineas. The three-year-old Blacklands Kingmaker (29102), the junior champion in London last year, fell to Sir Arthur Nicholson for 1750 guineas. Altogether thirty-two animals were sold, the aggregate realized being £14,530. 19s., representing the fine average per head of £454. 1s. 10d.

The Irish Homestead writes of the "poison of city life" which is stirring in the blood in the children of the hardy pioneers of the United States "who hewed down forests; whose fierce conflicts with the red man made the fortunes of a whole generation of story-tellers, who made a home in the wilderness for their children." In the United States, we read, while the cities are springing up like mushrooms and swelling rapidly as puffballs, the agricultural population slumps and agricultural production has hardly increased by a small percentage during the last ten years and is not at all keeping pace with the growing city populations. The States used to export food largely, yet in seven years, according to Mr. Hill, the United States will be a food-importing country, and will, with half a continent to cultivate and a

comparatively thin population per square mile compared with any European country, be importing food to feed its population. Farmers' unions and granges, agricultural associations, and State Colleges of Agriculture have proved unavailing to counteract the "poison of city life"; and now it has been decided—mainly through the counsels of Sir Horace Plumkett, the President of the Irish Agricultural Organization Society—to send a commission, consisting of two delegates from each State in the Union, to inquire into the organization of agriculture in Europe. The scope of the inquiry will be wide. It will embrace an examination of the methods employed in progressive agricultural communities in production and marketing and in the financing of these operations. Special note is to be taken of the parts played respectively in the promotion of agriculture by Governments and by voluntary organizations of the agricultural classes; the application of the co-operative system to agricultural production; distribution and finance; the effect of co-operative organization upon social conditions in rural communities; and the relation of the cost of living to the business organization of the food-producing classes.

"The value of keeping milk records" forms the title of an instructive article in *The Dairy*. It is pointed out that, apart from the benefits of the practice to the milk-seller and to the butter-maker, the keeping of these records presents great advantages to the dairy farmer who breeds his own cows. Milking qualities are largely hereditary, and the progeny of a heavy-milking cow are likely to inherit the characteristics of their dam. It is, therefore, of the first importance that the dairy farmer should have a record of the performances of his cows, and should select the heavy milkers to breed from for his own herd. Dairy qualities are also transmitted through the bull used, and it is equally important to be able to show that he is descended from a heavy-milking strain. The possession of a satisfactory milk record becomes in this way a very valuable asset, not only as a guide to breeding but also for sale purposes.

How land is being reclaimed from the Sacramento River is told by the *Pacific Rural Press*. Two "reclamation districts" have been dealt with, comprising 85,946 acres of the richest type of valley soil. This land has been built up by annual deposits of river silt, whose remarkable fertility is evidenced by the heavy growth of oaks, cotton wood, and willows, as well as by the crops of lucerne and beans that have grown inside of old levees. The work of the first two years was in charge of engineers, who began the levee building that is still going on. Bush cutters follow the engineers, and after the lands have been cleared they are ploughed and prepared for planting. None of the land has yet been offered to the public, the policy being one of complete development before colonization is encouraged. The work of reclamation is being carried out by the Natomas Consolidated of California, a company formed early in 1908. The company's agricultural experts (most of whom are from the College of Agriculture of the University of California) will advise the ultimate owners of the holdings; and in the meantime elaborate soil surveys are being taken of every acre of the reclaimed land. The Natomas Consolidated owns sixty thousand acres of the entire area of the two "reclamation districts," and will ultimately colonize these, thus adding to the producing population of the Sacramento Valley between four and five thousand families.

A rather striking result of crossing two different breeds is recorded by Mr. D. E. Stevens in the *Live Stock Journal*. Mr. Stevens crossed his Jersey cows with an Angus bull. The first cross Jersey-Angus, he says, is a very fine cow without horns, very like an Angus, with a Jersey head and eyes, and an excellent milker. He bred her to a Jersey bull; her heifer calf was of a lighter colour—almost blue-black; not so massive a cow, but an excellent milker giving very rich milk. Mr. Stevens crossed her heifer calf again with a Jersey bull, and he bred the cow he was anxious to get—a dark, almost black, Jersey, with beautiful Jersey head and horns, rich milk, an excellent milker, and a very handsome animal, much more robust than a true Jersey, still retaining all the good qualities of the Jersey. Mr. Stevens intends to continue breeding her with a Jersey bull. He adds: "The distant cross of the Angus is all I want to make the Jersey cow live and do well on any pasture. This last cow of mine has not been housed all the winter, and is in fine condition."

The *North British Agriculturist* notes the appearance of a new variety of wyandottes, known as "Exchequer wyandottes," to be introduced this season by Mr. Robert Miller, of Denny. Mr. Miller has been patiently working at this new variety for four years, his object being to produce a bird which would take the same prominent place among the heavy breeds as the Exchequer Leghorn, which also originated at Denny and was introduced in 1906, has taken among the light breeds. The colour and markings of the Exchequer wyandotte are similar to those of the Exchequer Leghorn. The bird is of true wyandotte type, and has a rose comb. It is livelier than the other kinds of wyandottes, has not the same tendency to broodiness, and keeps on laying very well both summer and winter. It is stated to be a fine table bird, in addition to its laying qualities.

The *Scientific American* states that a Maryland orchardist has found that the use of broken ice, packed about the roots of his apple trees, is a good expedient for retarding the premature blossoming of his trees in the spring-like weather that sometimes occurs in the winter.

Ayrshire Cattle.

By JOHN F. McCREATH, Experimental Farm, Potchefstroom.

HISTORY.

THIS breed of cattle was originally found in the district of Cunninghame in Ayrshire, Scotland, and while confined to that part of the country they were known as Cunninghame cattle. Later on Dunlop of Dunlop imported cattle from the north of England and carried on the improvement of these Cunninghame cattle by crossing with his imported stock. For a time after this they were known as Dunlop cattle, but as they got spread over the south-western counties of Scotland the term "Ayrshire" was applied to them, and they still retain that name. Not much is known of the early history of the breed, but its improvement started from about 1750. As far as can be gathered from the records of the breed previous to that, the Ayrshire was an inferior diminutive animal of a black and white colour. Owing to the severe climatic conditions of its home the Ayrshire was naturally one of the hardiest of animals, a characteristic which it still maintains to this day.

It is a well-known fact that the established breeds of Britain have been perfected by crossing, and the Ayrshire also falls into line in this respect.

In 1750 the Earl of Marchmont purchased from the Bishop of Durham several cows and a bull of the Teeswater or some other English breed of a light brown colour spotted with white. These His Lordship kept for some time at his seat in Berwickshire. Bruce Campbell, his factor in Ayrshire, carried some of the breed into that county. From there their progeny spread throughout the country. These cattle were of the Shorthorn type, but subsequently crossing with breeds of Holland took place. Probably from the red and white cattle of Holland part of the colouring of the Ayrshire of to-day is inherited. It is also possible that crossing with the West Highland cattle and the wild white cattle of Scotland also took place. Some of the characters of the modern Ayrshire, such as shape of horn, colour, and conformation, seem to indicate that such crossing did take place.

No names of improvers of Ayrshire cattle are outstanding. The improvement seems to have been pretty generally carried on in the districts where the Ayrshires were found. The first real systematic effort at improvement came about through the introduction of a scale of points by the Ayrshire Agricultural Association in 1853, and it may be considered to have been established as a pure-breed by that date. The next important step in the advancement of the Ayrshire was effected through the formation of the Ayrshire Cattle Herd-book Society of Great Britain and Ireland in 1877, and the following year the first volume of the herd-book was published. This herd-book has been published annually since that date, and contains the pedigrees of all animals registered, together with a few photographs of champion prize winners at the leading shows of Great Britain.

DISTRIBUTION.

At the present time the distribution of the Ayrshire is world wide. They followed Scotch settlement throughout all parts of the British

Empire. In Australia, New Zealand, and Canada large numbers are to be found, while in the United States of America, South Africa, Russia, Japan, Norway and Sweden, and Denmark they are found in smaller numbers. The introduction of the Ayrshire to America dates back as far as 1822. At the same time the Scotch settlers started to emigrate to Canada, and the breed has since made steady progress in that country. Several Canadian Ayrshire cattle societies are now in existence. In recent years quite a trade has sprung up between Sweden and Scotland, the Ayrshires being well suited to the severe climatic conditions of that country.

AYRSHIRE COW—"STRAWBERRY OF SKAITH."
First at Royal Show, England, 1901.

It is worthy of remark that Ayrshires are found in largest numbers in the countries which are large exporters of dairy products.

CHARACTERISTICS OF AYRSHIRES.

The Ayrshire is essentially a dairy cow, having been bred up and improved chiefly for milk production. While the Ayrshire was being improved as a milk producer it was recognized that the constitution must be maintained, with the result that to-day it is claimed for the Ayrshire that it is one of the hardiest, the most stylish, and graceful of all beasts. Generally of a brown and white colour, with head erect, and the most perfect formation of udder, the Ayrshire cannot fail to take the eye of any stockbreeder. As regards colour, this varies in different herds to some extent, but in individual herds is pretty uniform. Breeders in Canada favour those which are mostly white;

those in Japan and Sweden those which are more of a brown colour; so that to-day we have individual farmers in Scotland catering for the special requirements of each country.

The Ayrshire possesses a neat head of medium size, carrying well set up and stylish horns. The neck is fine, long, and clean-cut, well set on to head and shoulders. The body of the Ayrshire is capacious. possessing the typical wedge formation looked for in most dairy breeds. The ribs are long and well sprung, extending well downwards and backwards. The back is straight and the "plates" broad and level. The hindquarters are light as compared with other dairy breeds, and do not partake of fleshiness. The udder is the point that calls for special comment in this breed. It is not of a pendent character as in most other breeds. It is extremely broad, filling out the flanks on either side, extending well forward and level with the belly line of the animal. The sole is level, carrying large teats neatly placed and well in below the udder. Passing backwards the hindquarters of the udder are carried well up behind. Altogether the udder is superior in formation to that of any other dairy breed. Professor Plumb, of America, says:—"A row of Ayrshire cows in a show-ring alongside other dairy breeds is conspicuous for the uniform and superior type of udder."

SCALE OF POINTS.

The following scale of points was adopted by the Ayrshire Herd-book Society of Great Britain and Ireland in 1906:—

Scale of Points of Ayrshire Cow (1906).

	Points.
Head—8 Points.	
Forehead.—Broad and clearly defined	1
Horns.—Wide set on and inclining upward	1
Face.—Of medium length, slightly dished, clean cut, showing veins	1
Muzzle.—Broad and strong without coarseness, nostrils large...	1
Jaws.—Wide at the base and strong	1
Eyes.—Full and bright, with placid expression	2
Ears.—Of medium size and fine, carried alert	1
Neck—3 Points.	
Fine throughout, throat clean, neatly jointed to head and shoulders, of good length, moderately thin, nearly free from lose skin, elegant in bearing	3
Forequarters—11 Points.	
Shoulders.—Light, good distance through from point to point, but sharp at withers, smoothly blending into body	2
Chest.—Low, deep, and full between and back of forelegs ...	6
Brisket.—Light	1
Legs and Feet.—Legs straight and short, well apart, shanks fine and smooth, joints firm; feet medium size, round, solid, and deep	2
Body—13 Points.	
Back.—Strong and straight, chine lean, sharp, and open-jointed	4
Loin.—Broad, strong, and level	2
Ribs.—Long, broad, wide apart, and well sprung	3

	Points.
Abdomen.—Capacious, deep, firmly held up with strong muscular development	3
Flank.—Thin and arching	1
Hindquarters—11 Points.	
Rump.—Wide, level, and long from hooks to pin bones, a reasonable pelvic arch allowed	3
Hooks.—Wide apart and not projecting above back nor unduly overlaid with fat	2
Pin Bones.—High and wide apart	1
Thighs.—Thin, long, and wide apart	2
Tail.—Long, fine, set on a level with back	1
Legs and Feet.—Legs strong, short, straight when viewed from behind, and set well apart; shanks fine and smooth, joints firm; feet medium size, round, solid, and deep ...	2
Udder—20 Points.	
Long, wide, deep, but not pendulous nor fleshy; firmly attached to the body, extending well up behind and far forward; quarters even; sole nearly level and not extensively indented between teats; udder veins well developed and plainly visible	20
Teats—12 Points.	
Evenly placed, distance apart from side to side equal to half the breadth of the udder, from back to front equal to one-third the length; length $2\frac{1}{2}$ to $3\frac{1}{2}$ inches, and not less than 2 inches; thickness in keeping with length, hanging perpendicular and slightly tapering, and free flow of milk when pressed	12
Mammary Veins—5 Points.	
Large, long, tortuous, branching, and entering large orifices ...	5
Escutcheon—1 Point.	
Distinctly defined, spreading over thighs, and extending well upward	1
Colour—2 Points.	
Red of any shade, brown, or these with white, mahogany and white, black and white, or white; each colour distinctly defined. (Brindle markings allowed, but not desirable.)	2
Covering—6 Points.	
Skin.—Of medium thickness, mellow and elastic	3
Hair.—Soft and fine	2
Secretions.—Oily, of rich brown or yellow colour	1
Style—4 Points.	
Alert, vigorous, showing strong character; temperament mild. Weight at maturity from 800 to 1000 lb.	4
Total	100

The points of the bull differ from those of the cow only in masculine characters, which, according to the general rule, ought to be distinctly defined, although at one time a feminine tendency in the appearance of the bull was thought to indicate that he belonged to a good milking strain. The scrotum should be white and the rudimentary teats large and wide apart. His weight at maturity should be from 1200 lb. to 1500 lb.

MILK RECORDS.

On the cheese-making farms in the southern counties of Scotland, Ayrshire, Wigtownshire, Kirkcudbrightshire, and Dumfriesshire, the Ayrshire is exclusively used. It is the general custom in these countries to have the cows calving in the spring, in February and March. By the beginning of April they can be turned out to graze during the day and require very little stall-feeding, while about six weeks after this date it is customary to let the cows run at the grass both night and day with no additional feeding. Treated in this manner the Ayrshire cow gives a good supply of milk for nine months, generally beginning to fall off as the winter approaches and getting dry for about three months before calving. Thus the Ayrshire requires very little stall-feeding to keep her in condition during the cold winter months. In

AYRSHIRE BULL—"CARSEGOWAN CORONATION."
A noted Prize-winner in Scotland.

addition to being naturally adapted to the poor land of these districts, the Ayrshire gives milk possessing particularly small butter-fat globules especially suitable for the cheese-making industry carried on there.

The milk record campaign in Scotland was started by John Spier in 1902, and this strenuous advocate of the scheme saw his labours rewarded before his death—an irreparable loss to Scotland—in 1910. The Milk Records Society will remain a permanent memorial to his insight and wisdom. It is recognized on all sides that milk records are essential in any dairy herd, and yet it is one of the easiest things to over-develop this faculty to the ruin of other good qualities of the cow. This is the point where the showyard ought to be a pronounced factor in sustaining a type of animal at once healthy and a milk producer.

The milk record scheme in Scotland has made great strides since its inauguration in 1903. In that year there were 1342 cows being tested, and the numbers have increased to 18,000. At first the testing was under the supervision of the Highland and Agricultural Society, and continued thus till 1907. It was then recognized that some separate body was required to govern the scheme, and the Ayrshire Milk Record Society was constituted. Two years later the name was changed to the Scottish Milk Record Committee, which now carries out the testing of all the dairy herds belonging to members of the society.

In the Pan-American dairy test in 1901 for five cows of a dairy breed, Ayrshires came second to Holstein Friesians in largest yield of milk and net profits. In 120 days the five Ayrshires yielded 32,998.2 lb. milk, compared with 39,260.2 lb. for Holstein Friesians. The best Ayrshire yielded 7041.5 lb. of milk of 3.59 per cent. butter-fat.

The following record of an Ayrshire cow in Scotland gives a good idea of the breed as a valuable dairy asset:—"She has borne five living calves without going dry. One month before calving she yields 30 lb. of milk, or about half her normal maximum during the first three months of her lactation period. On the 'common' pasture in 1905, with no additional feeding, three weeks after calving she gave 30 lb. of milk at 6 a.m. and 28 lb. of milk at 6 p.m.; butter-fat by Gerber's test 5.4 per cent. Her weight after milking was 9 cwt. 2 qrs."

But it is not individual records which make a breed famous. Any cow can be fed and forced to yield abnormally large records. When the averages for herds are considered, and the conditions under which these averages are obtained, a true estimate of a breed is arrived at. The following averages have been obtained in the south-western counties of Scotland, where the cows are treated in the manner described in an earlier part of this article, and where the land is comparatively poor. In 1906 the average yield of milk, in eighteen dairies containing 443 cows (including heifers two and three years old), was 875 gallons of milk of 3 per cent. butter-fat in a lactation period ranging, as to individual cows, from about thirty-eight to nearly forty-six weeks. That 3 per cent. butter-fat must not be taken to mean that the average butter-fat was 3 per cent. It simply means that the standard 3 per cent. was chosen and the yields calculated accordingly. The average yield of Ayrshires may be put down at 650 to 700 gallons of milk of from 3.7 to 3.9 per cent. butter-fat.

AYRSHIRES IN SOUTH AFRICA.

Ayrshire herds in South Africa at the present day are few and far between. Before the milk record societies in Scotland were inaugurated importers were guided in their choice of animals by the Scottish showyards, and unfortunately the animals found there were as a rule the poorest milkers. Consequently these animals did not come up to expectations on arrival in this country, and for a time the Ayrshires got a set back. Now that the official records can be procured before purchases are effected the animals recently imported are of a much superior type. This will have the effect of creating a greater interest in the breed, and the exhibition of Ayrshires at last Johannesburg show was sufficient proof that a forward movement had already begun. Not only were the numbers largely increased, but the quality also was much better than has yet been seen at any South African show.

Ayrshire breeders in this country do not maintain that the Ayrshire will cut out—in town dairies where large milk yields, irrespective of butter-fat, are wanted—such heavy milking breeds as the Fries. On the other hand, they do maintain that under general veld conditions, where it is not customary to go in for heavy feeding, the breed will hold its own against any other dairy breed.

The author desires to express his thanks to Mr. Alex. Holm for some historical information and for valuable suggestions supplied during the writing of this paper.

The Construction of Silos in Stone and Brick.

By W. S. H. Cleghorne, B.Sc., A.M.I.Mech.E., Lecturer in Engineering, School of Agriculture, Potchefstroom.

Few events are wholly evil, and a good effect of the recent drought is the awakening to a fuller appreciation of the benefits to be derived from the making of ensilage which it has caused.

With its help the stock farmer can snap his fingers at drought, and, further, the number of head of stock which his farm can carry is no longer limited to that which can be sustained on his winter or dry season veld.

This article is intended to guide the farmer in the construction of a silo, and to furnish him with detailed plans for a square silo in stone or brick, this being the type most likely to be built by a farmer in this country. It ought to be read in conjunction with the articles by Mr. Burtt-Davy on "The Preservation and Use of Maize for Stock Feed," published in the *Agricultural Journal* for December, 1912, and succeeding numbers.

The conditions essential for preserving ensilage are, according to King, "close packing in an air-tight structure when the materials have reached the right stage of maturity."

Main Types.

Silos may be classified into two principal types:—

(*a*) Silos which are entirely below the surface of the ground, and which may be either unlined or lined with brick, masonry, corrugated iron, etc.

These are closed by a layer of earth placed on top of the silage.

(*b*) Silos which are mainly above the ground.

For convenience these two types will be referred to as "pit" and "tower" silos respectively.

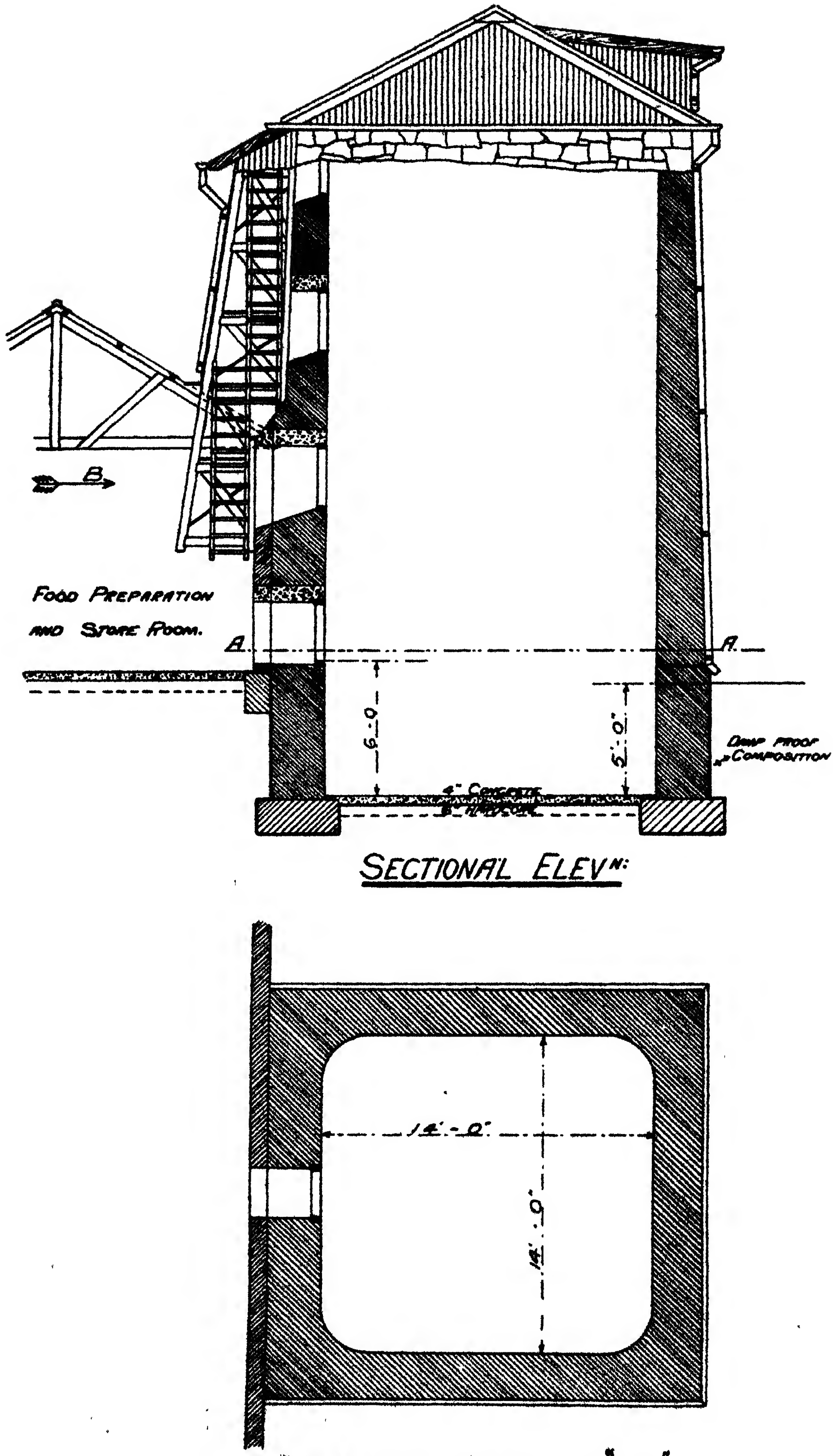


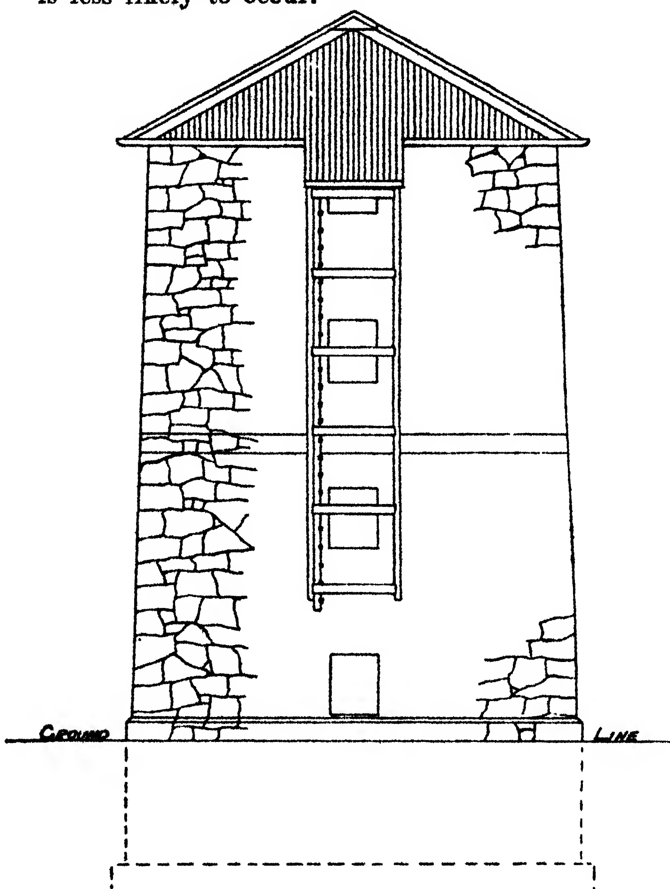
Fig. 1.

SCALE: ¼ inch = 1 foot.

DEPTH OF THE SILO.

The narrower and deeper a silo can be made within practicable limits the better on account of the close packing of the silage due to the large superincumbent weight, the effects of which are:—

1. Leakage of air between the walls of the silo and the silage is less likely to occur.



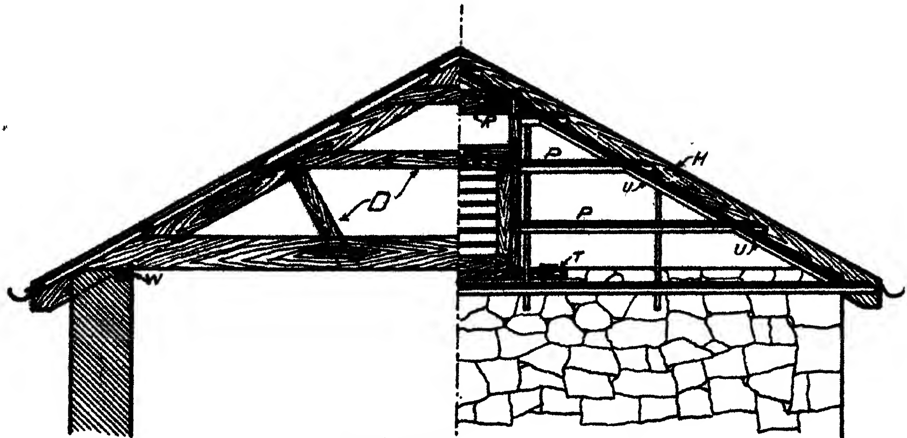
ELEVATION.

LOOKING IN DIRECTION OF ARROW "B"

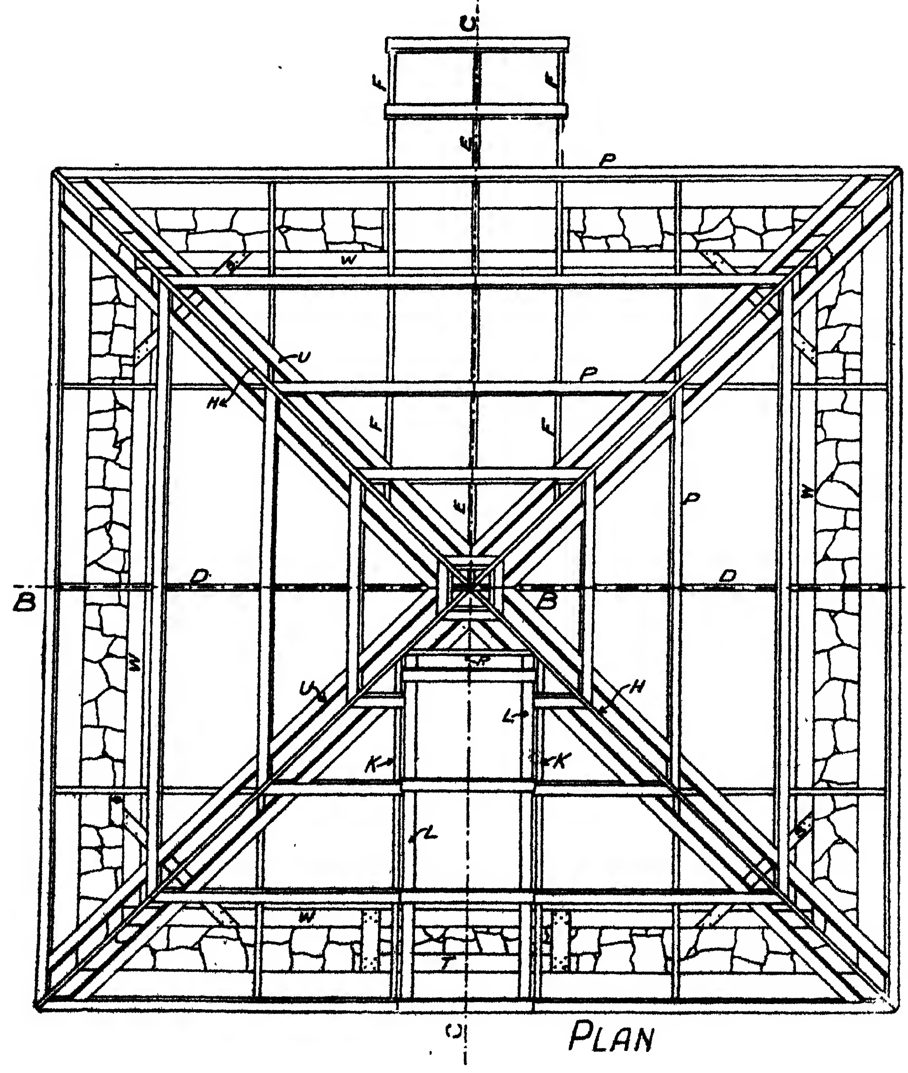
FOOD PREPN ROOM SUPPOSED REMOVED.

Fig. 1A. Scale: ¼ inch = 1 foot.

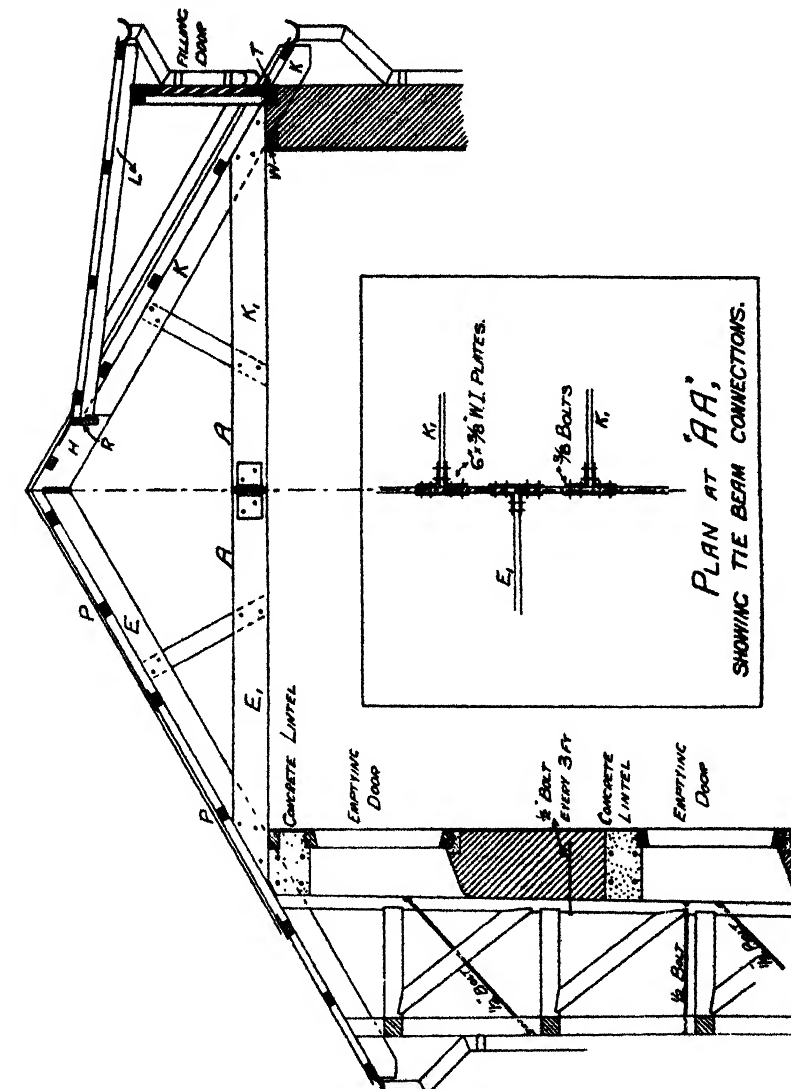
2. Storage space is saved, i.e. a narrow deep silo will store a greater total weight of silage than can be stored in a wider, shallower one of the same cubic capacity.
3. Less surface is exposed to the air, while the silage is being used layer by layer starting from the top, and there is therefore less chance of loss of surface silage than would be the case in a wider silo. "If the silage is fed down at a rate lower than 1.2 inches daily, moulding is likely to set in." (King.)



HALF SECTION ON "BB." HALF ELEVATION.



PLAN



SECTION ON "CC."

Scale: ¼ inch = 1 foot.

Fig. 2A.

The height of a tower silo is limited by the power required to elevate the stuff to fill the silo, the higher the silo the greater is the power required for this purpose. A common elevator is that of the pneumatic or blower type worked in conjunction with the ensilage cutter.

The above remarks apply more to "tower" than to "pit" silos, as, on account of the difficulty of emptying them, the latter cannot conveniently be made deeper than 8 or 9 feet. Pit silos are not fed down layer by layer starting from the top, as this would expose too much surface. The method adopted on this farm is to remove the silage in vertical sections of from 4 to 6 feet wide, across the width of the pit, the superincumbent earth resting on each section having been first removed, and each section being removed to its full depth before starting on a new one. If the silage is unchaffed, a rick-knife will be required for this operation.

The Pit Silo.

The pit silo is usually made rectangular, and, as already stated, should not exceed 8 or 9 feet in depth. If the soil is stiff, it need not be lined, and it is a good plan to leave a stairway in the natural earth at one corner while excavating in order to facilitate emptying the silo (see Mr. Burtt-Davy's article in the January *Journal* for further information on this subject).

The Tower Silo.

Tower silos are, as a rule, built partially below, but mainly above the ground. They are provided with one filling door in the roof and a number of air-tight emptying doors in a vertical row down one side. The depth of that part of the silo which is below the ground should not exceed that which conveniently allows of the lower silage being thrown out of the lowest emptying door. This limiting depth is about 6 feet from floor of silo to sill of lowest emptying door. By building as much as possible of the silo below ground, we diminish the height to which the silage must be elevated in filling the silo, and gain the advantage of a supporting earth backing to the outside of that part which is below ground.

Pressure Exerted by Ensilage on Walls of Silo.

The outward or lateral pressure of cut mealie silage when settling increases proportionately to the depth below the surface of the silage. Thus at 15 feet from the surface it is about 165 lb. on each square foot of wall surface, while at a depth of 30 feet it is twice as much, or 330 lb. on each square foot. For this reason the walls of silos must be very strong.

Form of Silo.

In the circular form the materials are best disposed to resist the above outward or bursting pressure, which in this case is resisted by tensile stresses set up in the walls. This form also allows of better packing or consolidation of the silage because of the absence of corners.

Stone and brick silos are frequently built of square shape (in plan) on account of less skill being required than in the building of a round silo. Square silos also fit in better with other buildings. The interior corners of a square silo should be well rounded so as to impede settling and consolidation of the mass as little as possible.

WEIGHT OF SILAGE TO BE STORED.

In calculating the weight of silage to be stored, the usual basis is to allow 40 lb. per cow per day, though for a mixed herd, and when other food is available, the allowance per head per day would be considerably less. Taking the figure 40 lb., the total weight to be stored in short tons will equal the number of animals to be fed multiplied by the number of days during which they have to be fed, multiplied by 40 and divided by 2000.

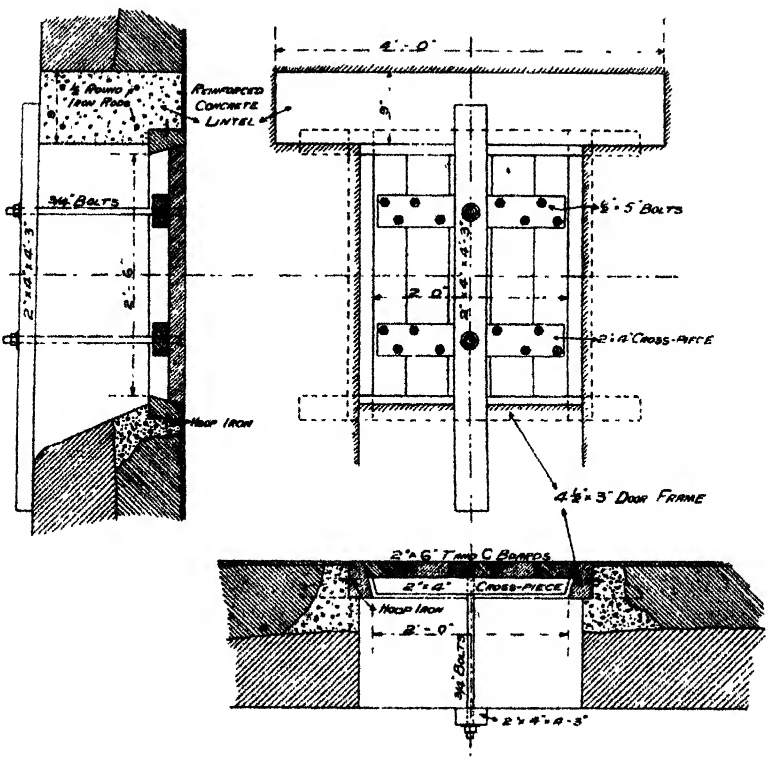


Fig. 3. Scale: ¼ inch = 1 foot.

CUBIC CAPACITY OF SILO.

To find the capacity in cubic feet of a rectangular pit silo, or of a square or rectangular tower silo, multiply together the length, width, and height, each expressed in feet. This neglects the slight loss of capacity due to rounding the interior corners.

Thus the silo illustrated is 14 feet square by 30 feet high, its capacity is therefore—

$$14 \times 14 \times 30 = 5880 \text{ cubic feet.}$$

To find the capacity in cubic feet of a circular silo, multiply the square of the diameter in feet by the height, also in feet, and then by 0.7854.

TOTAL WEIGHT OF SILAGE STORED IN A SILO.

This is found by multiplying the capacity of the silo in cubic feet by the average density or weight per cubic foot of the silage.

According to King, the average density may be taken as 36.5 lb. per cubic foot for a silo 25 feet deep, and 39.6 lb. per cubic foot for a silo 30 feet deep.

Thus the silo illustrated will hold—

$$5880 \times 39.6$$
$$= 232{,}848 \text{ lb.}$$
$$= 116 \text{ short tons fully.}$$

Having settled the size of the silo to be erected, the next thing which occupies our attention is the construction.

MATERIALS OF CONSTRUCTION.

The materials of construction most likely to come into extensive use in this country are stone, brick, and reinforced concrete. In parts of America where wood is plentiful, wood stave silos are used. These silos are circular, and are constructed of wooden staves set on a stone foundation and held together by iron hoops. The wood stave silo is open to many grave objections, most of which would probably be aggravated by the climate of this country.

All-metal silos are also manufactured, but seem open to the objection that the plates composing them are subject to the corrosive action of the silage juices.

The silo illustrated may be constructed of either stone or brick.

PART BELOW GROUND.

This (in the design illustrated) should preferably be built in cement mortar, and is best made of stonework, even though the remainder of the walls above ground are of brick. In place of using pure cement mortar, a cheaper mortar may be employed consisting of one part cement to four parts lime to fifteen parts clean sharp sand. In the latter case, if the site is damp, the whole of the outer surface of that part below ground had better be coated with a damp-proof composition, consisting of one part tar, two parts pitch, and four resin, applied hot. The walls of the bottom portion of the silo are 27 inches thick, and are carried at least one foot above the ground in the case of the upper walls being of brick.

The silo should not be filled for at least two months after completion, in order to give the mortar in the walls time to season.

Great care should be taken in building the lower part of the silo, and also the parts surrounding the emptying doors, especially the lower ones, as the walls are subjected to the greatest pressure at the base.

The excavation in the earth to receive the lower part of the silo should be made large enough to allow of thorough tamping of the earth-filling, so that it may act as a strong backing to the wall.

THE WALLS ABOVE GROUND.

If of stone, these may be 24 inches thick at the bottom, tapering to 16 inches at the top. If of brick, the walls may be 2½ bricks or 22 inches thick at the bottom, and 1½ brick or 14 inches thick at the top. They should be built in English bond, the bricks being laid while in a wet condition. If of stone, the walls should have large through stones or bonders every 3 or 4 feet apart measuring horizontally. Midway between each pair of bonders should be a header, i.e. a stone extending from the face of the wall through at least two-thirds of its thickness, these headers extending alternately from the

inside face and from the outside face of the wall. These bonders and headers should break line vertically.

The walls should be strengthened by building in strong hoop-iron bands at frequent intervals. The lower part of the silo, and between the emptying doors, should be specially strongly reinforced in this way. The parts weakened by the emptying doors may be further strengthened by building in long fencing standards above and below the doors.

THE ROOF.

The roof is shown in detail in Figs. 2 and 2A. In it the filling door is constructed, and part of it projects so as to form a roof for a chute down which the ensilage from the emptying doors passes.

The wallplates, W, 4½ by 3 inches, are half-checked to each other at the corners, and are further bound together at the corners by 3 by 3 inch angle pieces, S.

The main principal, D, is specially strong and is put together on the ground.

The common rafters are 6 inches by 1½ inch, while the hip rafters, H, are 9 inches by 1½ inch. The hip rafters project above the ordinary rafters and carry the iron ridging for the corrugated iron roof covering.

The purlins are 3 inches by 2 inches. The 4½-inch by 3-inch filling door frame is fixed at the bottom to an outer wallplate, T, and at the top to the 3-inch by 3-inch rafters, L, which in turn are nailed to the board, R, between the hip rafters.

In order to prevent rotting and corrosion of the roof by the gases given off by the silage while fermenting, it must be well ventilated. This is effected by leaving an opening round the eaves between the iron of the roof and the masonry of the walls, and by making the filling door of louvre form.

The space between the top of the filling door frame and the iron of the roof above it is also left open.

Another method of ventilating is to have a ventilator on the apex of the roof, leaving the aforementioned opening round the eaves.

EMPTYING DOORS.

It is important that these should be strong, durable, and air-tight. They should preferably be made of hard wood. Figure 3 is a detail drawing of a good type of emptying door, 2 feet 6 inches high by 2 feet wide.

The opening in the masonry is spanned by a concrete lintel 9 inches deep, reinforced by four half-inch round iron rods.

This lintel is moulded in place, the reinforcing rods being meanwhile held in position by their ends passing through holes in the ends of the wooden mould.

The door frame is 4½ inches by 3 inches in section, and to secure air-tightness is bedded in cement mortar, a strip of hoop-iron being bedded partly in the wood of the door frame and partly in the mortar all the way round the frame.

The door itself is constructed of grooved and tongued boards 2 inches thick by 6 inches wide, bolted to two 2 inches by 4 inches cross pieces. Its edge is bevelled, and the door frame is accurately bevelled to suit. The door is placed in position from the *inside* of

the silo, and is therefore held tightly closed by the outward pressure of the silage behind it. It is also held in place by two $\frac{3}{4}$-inch bolts passing through the 2 inches by 4 inches bridge piece shown.

CHUTE.

A vertical chute down which the silage from the emptying doors can fall is an advantage. A design for a chute is illustrated by Figs. 1, 1A, 2, and 2A. The lower end of the chute may, if desired, be fitted with a sloping bottom so as to direct the falling silage into the cart or barrow used for distributing the silage to the mangers. The design given is for a chute consisting of timber framing covered with corrugated iron. The frame is constructed of $4\frac{1}{2}$ inches by 3 inches timbers, and is attached to two similar timbers bolted, on the flat, to the wall of the silo by means of $\frac{1}{2}$-inch bolts at intervals of 3 feet vertically. These bolts are built into the wall, forming two vertical rows one on either side of the emptying doors. The sides of the chute are supported and held together by the diagonal and horizontal bolts shown (Figs. 2A and 1).

A very convenient and labour-saving arrangement is to have the silo built close against the wall of the food preparation room, with the chute passing through the roof of the latter. The silage is then discharged direct into the feed-room.

For this arrangement the chute would require to be modified, as shown in Fig. 1, and openings, bridged by 9 inches concrete lintels, would be formed in the wall of the feed-room opposite the two lower silo emptying doors, or the wall of the silo can replace part of that of the feed-room. A ladder should be fixed up one side of the chute so that access to the silo can be gained through the emptying doors (see Fig. 1).

FLOOR.

If the site of the silo is dry throughout the year, a floor of beaten ant-heap laid on a 6-inch layer of hard-core (broken stone or bricks) will suffice.

Under other circumstances the floor may consist of a 4-inch layer of concrete carried on a 6-inch layer of hard-core. If the foundation is waterlogged, the waterproof composition already mentioned may be applied hot below the floor by first tamping in the hard-core with sand and applying the waterproofing to the smooth surface so formed.

PLASTERING.

The inside of the silo should be plastered with a layer of cement plaster consisting of one part cement to one and a half or two parts of clean sharp sand trowelled as smooth as possible. The plaster is made rich and of the best quality in order to enable it to resist the destructive action of the silage juices. The smoother the surface of the plaster the better is this destructive action resisted, and also the less is the settlement and close packing of the silage resisted.

Before applying the plaster the joints should be raked out to a depth of $\frac{3}{4}$ inch to form a key for the plaster, and if of brick, the walls should be thoroughly wetted.

If inferior brick has been used for the walls the outside of the silo may be plastered with lime or cement plaster. In the case of good bricks, it will be sufficient to rake out the joints and point with lime or cement mortar.

If the walls are of stone they should be pointed with cement mortar.

It will probably be found advisable to cement-wash the inside lining of the silo, especially the lower portion, every two or three years in order to help to prevent softening of the plaster by the silage juices.

Kopjes Irrigation Scheme, Orange Free State.

ANALYSES OF THE SOILS TAKEN FROM IRRIGABLE LANDS BELOW THE DAM.

By J. MULLER, B.A., Senior Chemist, Capetown.

DURING April last year I visited the site of the irrigation works at Kopjes, Orange Free State, for the purpose of procuring samples of the soil there for analysis, in order to investigate the possibility of the occurrence of brack and also in how far in other respects the soil had prospects of productivity. After collecting thirty-six samples of soil from lands on the above site I proceeded also to the Roodepoort Settlement on General De Wet's farm and there collected four more soils. The Kopjes Scheme, it is understood, will extend over an area of about fourteen to fifteen miles in length, and the overflow furrow, thence crossing the railway line, will enter the settlement area, so that in view of the possibile utilization of the overflow water from the works above, and the consequent extension of the irrigation area so as to include Roodepoort, it was considered desirable also to investigate the nature of the soil at the latter locality.

From ten to twelve miles up the river, in an easterly direction from the spot where the railway crosses the latter, the reservoir is situated, and was in course of construction at the time of my visit. The main furrow opens up on the large basin along the right bank of the river just below the farm Tulpdraai, and about 200 to 300 yards below the men's compound.

On the attached diagram will be seen more clearly the natural slope of the almost level strip running between the Rhenoster River and the hills which are in some places from two to three miles away on the right bank of the river.

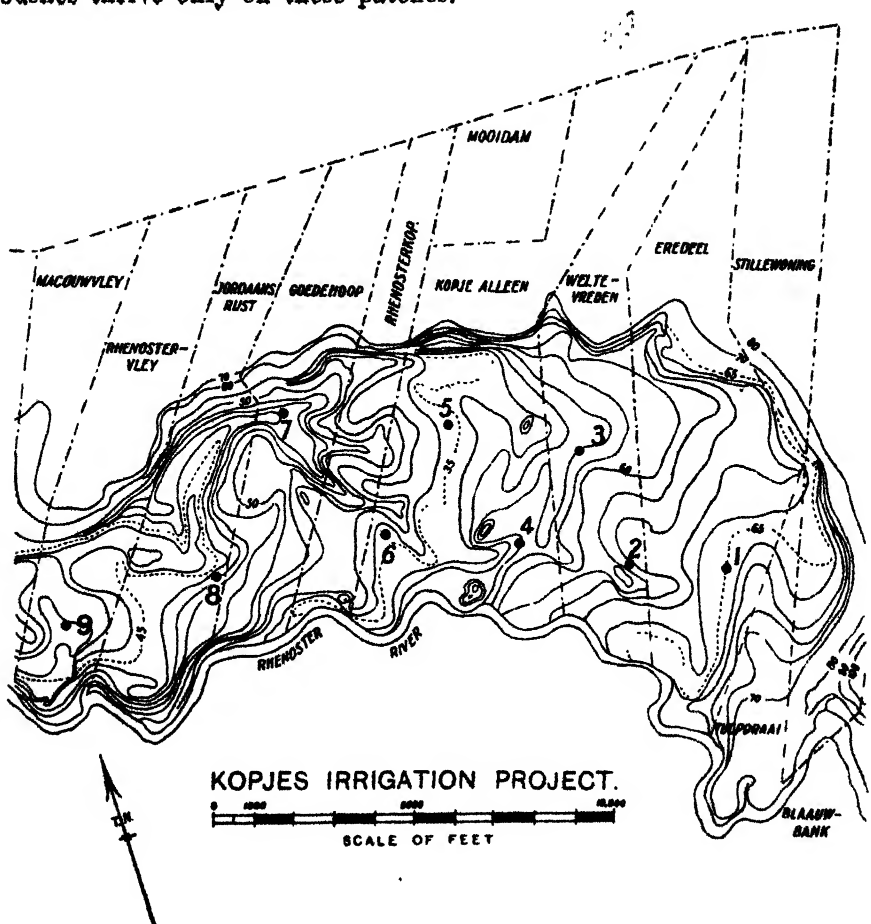
As already stated, the object in view was to ascertain whether there was any indication of "brak" (alkali salts) in the irrigable area and, if not at the surface, whether the sub-strata at any point may not be so impregnated and possibly after repeated irrigation render the surface soil "brak" too.

Nine separate holes were made, the spots being indicated by numbers 1 to 9 on the attached diagram. Each hole was dug to a depth of 4 feet, and four samples of soil collected, each sample representing a section of the soil at a depth of 1, 2, 3, and 4 feet respectively.

The following is a list of the samples with a description of the soil and surrounding area:—

1st Hole.—Samples 1 to 4, about 1500 yards from men's compound between telephone line and road: dark stiff clay soil, known locally as "turf grond."

2nd Hole.—Samples 5 to 8, about 800 yards further along the telephone line and about same distance from the main road: soil looser but with evidence of "brak" and scantier vegetation; ganna bushes thrive only on these patches.



3rd Hole.—Samples 9 to 12, at a spot about half a mile from the last hole and nearly 700 to 800 yards from the branch furrow along the foot of the surrounding hills: very dark clayey soil; about 36 inches deep it becomes more sandy. It is typical of a belt of about 110 yards wide running almost parallel to the telephone line; towards Kopje Alleen it inclines towards it.

4th Hole.—Samples 13 to 16, about 100 yards from the road and 600 to 700 yards from Kopje Alleen amongst some old lands, but taken from a virgin patch—a hollow strip running at right angles to the main road. The soil is somewhat more sandy than in the first hole.

5th Hole.—Samples 17 to 20. About 1000 yards from Kopje Alleen and nearly 400 yards south-west of the kopje on the opposite side of the road, there is a broad circular patch with scanty vegetation and very "brak" in appearance. There I made a similar hole, the efflorescence showing on the surface. The soil is somewhat similar to that obtained in hole No. 2.

6th Hole.—Samples 21 to 24. On the opposite side of the branch furrow which here inclines towards Kopje Alleen and about 600 yards from the latter kopje, there appears a continuation of the former "brak" patch; this (not very broad) extends right along the main road on the right going to the station, and after crossing the canal it appears on the left of the road. It is clearly indicated by the ganna bush and otherwise scanty vegetation.

7th Hole.—Samples 25 to 28, about a mile north-west of the outer kopje to the right of main road to the station and just under the furrow along the ridges: there also were indications which led me to suspect "brak." Vegetation similar to that described in case of 5 and 6.

8th Hole.—Samples 29 to 32. Passing Kopje Alleen the river soon bends to the left leaving a large flat plateau on the right bank from 1-1½ miles broad. At a spot about the centre of the latter and nearly 1500 yards from the road these samples were taken.

9th Hole.—Samples 33 to 36. About three-quarters of a mile in the centre of the plateau there is a round depression, possibly 200 to 400 yards across, the soil is very dark and the vegetation coarse rank grass, but no evidence of brak noticeable.

ROODEPOORT SETTLEMENT.

The superintendent of the settlement at Roodepoort, which is 2½ miles west of Kopjes Station on the farm purchased from General C. de Wet, conveyed me thither on the 28th April for the purpose of investigating the areas proposed to be placed under irrigation by continuing the furrow from Kopjes (a distance of about 18 miles) to the storage reservoir on the farm of Mr. A. J. Wilken, Cornelia, Vredefort. From here, the lands lying to the south-west and west are on a level plateau and can easily be placed under irrigation; it is 1 to 1½ miles wide and extends some 14 to 16 miles along the right bank of the Rhenoster River opening up enormous possibilities once the water is laid on.

The following samples were selected as indicated by Messrs. P. W. B. Wessels and A. J. Wilken:—

Sample No. 37, taken to a depth of 12 inches on the lands due west about 300 yards from the dam on Mr. Wilken's farm. It is a dark turf, virgin soil, and had just been ploughed and sown with lucerne. It is described as being excellent for oats. It is more sandy than No. 38. Nodules of limestone grains were found in this sample.

Sample No. 38 was taken from a virgin patch about a quarter of a mile further west from the dam on the above plateau. It is a stiff clayey soil, or, as locally known, "very tough soil," and is typical of that extending for miles further west on the same plateau. It pulverizes when ploughed after first showers of rain and becomes very friable and loose.

Sample No. 39 was taken from a brack patch about 100 to 200 yards from the latter sample, No. 38. It has been cultivated and irrigated and shows brack efflorescence on surface. The sub-soil is of a stiff clayey nature and rises to a foot from the surface.

Sample No. 40 is typical of the soil found along the rises or peculiar little basalt kopjes which jut out at intervals along these level flats. This sample was taken quite close to the homestead (about 90 yards) of Mr. Wilken, Cornelia.

Fruit trees, lucerne, and mealies all do remarkably well in this soil.

The analysis of these soils was entrusted to Mr. W. Versfeld, B.A., B.Sc., of the Capetown Laboratory, who reported on the samples in the following terms:—

In appearance the samples were as follows:—

Hole No. 1.—First, second, and third feet very dark and very clayey soils; fourth foot lighter in colour and somewhat less clayey.

Hole No. 2.—First, second, and third feet very dark soil, more sandy than Hole No. 1 and getting more sandy in depth. Fourth foot much lighter in colour, apparently a physically good soil.

Hole No. 3.—First, second, and third feet very dark, stiff clayey soil; fourth foot dark, but quite sandy compared with upper layers.

Hole No. 4.—First to fourth foot very dark, very clayey at surface but getting less so in depth.

Hole No. 5.—Grayish yellow soil, darker at surface, fairly sandy.

Hole No. 6.—First and second feet nearly black, stiff clayey soils; third and fourth feet lighter in colour and fairly sandy.

Hole No. 7.—Throughout the whole depth the samples are fairly light in colour (yellowish brown) and are distinctly more sandy than most of the others. At the third foot the soil contains some pebbles of lime tufa.

Hole No. 8.—First and second feet black, stiff clayey soil; third and fourth feet lighter in colour but also clayey, and containing pebbles of lime tufa.

Hole No. 9.—Very similar to Hole No. 8.

Sample No. 37 is a black, tough clayey soil. No. 38 is similar to No. 37 in appearance, but contains pebbles of lime tufa. No. 39 is a dark brown gritty loam. No. 40 is a black, tough clayey soil.

The results of the partial mechanical analysis of these soils are as follows:—

No. of Hole.	No. of Sample.	Pebbles, > 3 mm.	Gravel and coarse sand, 3 to ½ mm.	Fine earth, < ½ mm.	Nature of Residue on Sieves.
		%	%	%	
1	1	nil	0·18	99·82	Mostly quartz grains.
	2	"	0·51	99·49	Quartz grains and lime tufa.
2	5	"	0·40	99·60	Quartz grains.
	6	"	0·47	99·53	Quartz grains and some lime tufa.
3	9	"	0·31	99·69	Quartz grains and pellets of brown iron ore.
	10	"	0·11	99·89	Lime tufa and a little quartz.
4	13	"	1·45	98·55	Quartz grains and brown iron ore.
	14	"	1·80	98·20	" " "
5	17	"	0·75	99·25	Quartz grains and little lime tufa.
	18	0·21	1·21	98·58	Quartz grains and lime tufa.
6	21	nil	1·57	98·43	Quartz grains, a little slate, and volcanic rock.
	22	"	1·57	98·43	" " " "
7	25	"	0·49	99·51	Quartz grains, lime tufa, and brown iron ore.
	26	0·17	0·53	99·30	Lime tufa, quartz, and brown iron ore.

No. of Hole.	No. of Sample.	Pebbles, > 3 mm.	Gravel and coarse sand, 3 to ½ mm.	Fine earth, < ½ mm.	Nature of Residue on Sieves.
		%	%	%	
8	29	nil	0·70	99·30	Quartz and brown iron ore.
	30	"	0·62	99·38	" " "
9	33	"	0·40	99·60	Brown iron ore and a little quartz.
	34	"	0·51	99·49	" " "
	37	"	0·09	99·91	" " "
	38	0·11	1·25	98·64	Quartz grains and lime tufa.
	39	0·74	9·17	90·09	Decomposed dolerite.
	40	nil	0·06	99·94	Brown iron ore and a little quartz.

The results of the "brak" analyses of the soils are as follows:—

No. of Sample.	Sodium chloride.	Sodium sulphate.	Sodium carbonate.	Total alkali salts.	Calcium sulphate.	Calcium carbonate.	Magnesium sulphate.	Magnesium carbonate.	Total soluble salts By analysis.	Total soluble salts By weighing.
Hole 1	%	%	%	%	%	%	%	%	%	%
1	·037	·048	nil	·085	nil	·028	·024	·017	·156	·140
2	·035	·035	nil	·070	nil	·037	nil	·025	·132	·128
3	·034	·043	nil	·077	nil	·029	nil	·021	·127	·136
4	·049	·011	nil	·060	·019	·039	·018	nil	·136	·156
Hole 2										
5	·038	·072	nil	·110	nil	·023	nil	·021	·154	·132
6	·046	·070	·012	·128	nil	·024	nil	·017	·169	·160
7	023	·064	·003	·090	nil	·021	nil	·021	·132	·120
8	·077	nil	nil	·077	nil	·037	·024	·013	·151	·146
Hole 3										
9	·051	·032	nil	·083	nil	·020	nil	·017	·120	·120
10	·054	·088	nil	·142	nil	·018	·017	·021	·178	·176
11	·077	·516	nil	·593	·179	nil	·110	nil	·882	·624
12	·059	·053	nil	·112	nil	·018	·036	·010	·176	·140
Hole 4										
13	·030	·092	nil	·122	nil	·020	·009	·013	·164	·124
14	·023	·119	nil	·142	nil	·011	nil	·019	·172	·104
15	·046	·058	·012	·116	nil	·012	nil	·025	·153	·148
16	·020	nil	nil	·020	nil	·020	·011	·021	·072	·072
Hole 5										
17	·280	·018	nil	·298	nil	·023	·086	·061	·468	·500
18	·389	·310	nil	·699	nil	·039	·063	·017	·818	·704
19	·261	·452	nil	·713	nil	·036	·021	·011	·781	·756
20	·222	·468	nil	·690	·027	·041	·099	nil	·857	·808
Hole 6										
21	·068	·044	·031	·143	nil	·023	nil	·010	·176	·136
22	·049	·027	·041	·117	nil	·018	nil	·006	·141	·146
23	·066	·085	·039	·190	nil	·018	nil	·004	·212	·228
24	·051	·035	·058	·144	nil	·011	nil	·002	·157	·160
Hole 7										
25	·122	·106	·057	·285	nil	·034	nil	·002	·321	·282
26	·200	·532	nil	·732	·100	·007	·039	nil	·878	·748
27	·150	·378	nil	·528	·027	·041	·026	nil	·622	·524
28	·122	·202	·005	·329	nil	·021	nil	·002	·352	·332
Hole 8										
29	·026	·046	·024	·096	nil	·012	nil	·004	·112	·100
30	·051	·094	·053	·198	nil	·011	nil	·002	·211	·176
31	·033	·084	·027	·144	nil	·014	nil	·002	·160	·216
32	·043	·073	·046	·162	nil	·018	nil	·002	·182	·192

No. of Sample.	Sodium chloride.	Sodium sulphate.	Sodium carbonate.	Total alkali salts.	Calcium sulphate.	Calcium carbonate.	Magnesium sulphate.	Magnesium carbonate.	Total soluble salts. By analysis.	Total soluble salts. By weighing.
Hole 9	%	%	%	%	%	%	%	%	%	%
33	·027	·025	·024	·076	nil	·018	nil	·002	·096	·140
34	·054	·014	·017	·085	nil	·016	nil	·002	·103	·148
35	·038	·021	·024	·083	nil	·009	nil	·002	·094	·128
36	·026	·016	·048	·090	nil	·011	nil	·002	·103	·124
Roodepoort										
37	·023	·014	·024	·061	nil	·020	nil	·002	·083	·124
38	·378	1·270	nil	1·648	nil	·020	·018	·033	1·719	1·780
39	·033	·007	·005	·045	nil	·039	nil	·006	·090	·112
40	·045	·016	·029	·090	nil	·016	nil	·002	·108	·108

It will be seen that in the case of the first sixteen samples the amount of "brak" is, with one exception, not high, there being on an average only a little over .1 per cent. of total soluble salts. The exception is at the third foot of Hole No. 3 where the amount of soluble salts rises to nearly .9 per cent.

In Holes Nos. 1 and 2 there is not an appreciable difference in the percentages at different depths, and the amount of soluble salts found is not injurious.

In Hole No. 3 also the amount of the soluble salts is not injurious, except at the third foot, where a considerable increase is noticed. On irrigation this is bound to be distributed in the surface layers of soil as well.

In Hole No. 4, the first three feet of soil contain about the same amount of soluble salts as in the other holes, but at the fourth foot there is a considerable decrease. This is most probably due to there being a sandy layer of soil at this depth, sand not being able to retain salts to the same extent as clay.

In the fifth hole the amount of soluble salts is excessive and increases with depth.

In the case of Holes Nos. 6, 8, and 9 the amount of brack is not excessive. Nos. 6 and 8 are very similar with regard to the distribution of soluble salts, each showing an increase in depth down to the third foot and then a slight decrease at the fourth.

In Hole No. 7 the amount of brack salts is excessive, most being found at the second and third foot.

Of the Roodepoort samples, No. 38 shows a very large proportion of injurious salts, consisting largely of sodium sulphate. In its present condition it will prove a very inferior soil. Samples Nos. 37, 39, and 40 do not contain an injurious proportion of brack salts.

It seems as if the spots furthest from the river contain more "brak" than those nearer. This I consider is mainly due to the better conditions of drainage existing near the river channel.

In all cases sodium sulphate is the principal "brak" constituent along with sodium chloride which comes next, and in Hole No. 5 is present in considerable quantities. In some cases magnesium sulphate is found in small quantities. Fortunately, the most injurious constituent of "brak" soils, namely, sodic carbonate, is almost entirely absent in the first five holes, but is present in Holes Nos. 6, 7, 8, and 9, and also in Samples 37 and 40, in quantities, which, though not

great, ***will not stand much increasing without serious deterioration of the soil.***

A considerable part of the ground it is proposed to irrigate will probably be found to be quite suitable as far as "brak" is concerned, but I fear some difficulty will be met with owing to the physical condition of the soil in general.

On drying, most of the samples caked very badly, and the soil would require a great deal of loosening material worked into it to ensure good results. Good drainage and thorough cultivation are absolutely essential to increase the porosity of the soil.

In the following table are given the percentage quantities of plant food in reserve in the samples of soil:—

No. of Hole.	No. of Sample.	Fine earth.	Moisture.	Organic matter.	Chlorine.	Total soluble salts.	Nitrogen.	Lime.	Magnesia.	Potash.	Phosphoric oxide.
		%	%	%	%	%	%	%	%	%	%
1	1	99·82	8·27	6·63	·0224	·140	·098	·657	·650	·069	·042
	2	99·49	8·67	6·22	·0212	·128	·070	·744	·701	·061	·040
2	5	99·60	6·49	5·40	·0230	·132	·091	·452	·412	·067	·036
	6	99·53	6·88	5·24	·0279	·160	·070	·880	·546	·050	·038
3	9	99·69	9·27	6·25	·0309	·120	·091	·762	·711	·095	·047
	10	99·89	9·22	6·66	·0327	·176	·077	·786	·757	·109	·047
4	13	98·55	7·07	5·37	·0182	·124	·091	·435	·359	·051	·051
	14	98·20	8·20	5·26	·0139	·104	·076	·490	·388	·036	·045
5	17	99·25	6·01	4·20	·1697	·500	·091	·425	·429	·073	·048
	18	98·58	5·89	3·48	·2357	·704	·074	·683	·537	·083	·048
6	21	98·43	6·67	4·83	·0412	·136	·088	·493	·469	·097	·040
	22	98·43	7·14	4·75	·0297	·146	·060	·884	·490	·098	·065
7	25	99·51	6·20	5·19	·0739	·282	·070	·506	·249	·088	·042
	26	99·30	6·95	4·57	·1212	·748	·032	·578	·459	·086	·043
8	29	99·30	6·51	5·88	·0158	·100	·094	·430	·432	·063	·050
	30	99·38	7·62	5·92	·0309	·176	·088	·591	·242	·079	·038
9	33	99·60	6·67	6·32	·0164	·140	·098	·553	·427	·071	·041
	34	99·49	6·31	6·41	·0327	·148	·084	·697	·129	·077	·037
	37	99·91	9·06	7·11	·0139	·124	·133	·988	·315	·107	·060
	38	98·64	6·14	4·60	·2291	1·780	·077	·874	·422	·129	·042
	39	90·09	6·13	7·79	·0200	·112	·193	·723	·480	·136	·177
	40	99·94	9·08	8·03	·0273	·108	·123	·794	·424	·090	·054

It will be seen that in all the samples the percentage of moisture is high, as is to be expected in clayey soils. There is very little difference in this respect between the surface samples and those taken at the second foot.

The organic matter is also rather high, and it is worthy of note that in most cases the second foot contains somewhat less than the surface samples. In a few cases they are about the same. This brings us to the nitrogen where we find that in every case the amount at the second foot is appreciably lower than in the surface sample. The average percentage of nitrogen is not low. This is to be expected in soils containing a fair amount of organic matter.

In the case of Samples Nos. 37, 39, and 40, which contain the highest percentage of organic matter, the proportion of nitrogen is also highest. In these three cases the amount of nitrogen is quite satisfactory, No. 39 being, in fact, very high.

The percentages of lime and magnesia are in all cases ample.

The proportion of potash is, on the whole, fair, the last four samples being best off in this respect. It is probable that more of the

potash present is derived from the organic matter than from the disintegration of rocks.

It is in the percentage of phosphoric oxide that these samples fail to come up to the standard of a satisfactory soil. In every case, except No. 39, the amount is quite insufficient.

Sample No. 39 appears to be in a class by itself. Physically it is superior to most of the others, being less clayey. It is evidently a soil consisting largely of decomposed dolerite, and is described as having been cultivated and irrigated. While it is probable that its richness in plant foods is partly owing to added fertilizers, I am of opinion that it is still more due to the fact that the soil has been derived from a rock, which, in disintegrating, supplies these materials. This remark applies particularly to phosphoric oxide, which is derived from apatite, contained in volcanic rocks, such as dolerite, from which this particular soil has been formed.

The nitrogen, which has no such source, must have been derived partly from added fertilizers, but mostly from the large amount of organic matter present.

Many of the samples contain manganese. As far as is known this is of no agricultural significance, but it is certainly of geological interest, as indicating the proximity of deposits of this mineral.

The results of the examination of the coarse residues on the sieves proved to be rather interesting. Apart from the fact that these residues are an indication of the origin of the soils, in this instance they also give us an insight into their probable physical condition. In several instances the coarse material was seen to consist largely of pellets of brown iron ore, the origin of which is similar to that of bog iron ore, namely, the oxidation of salts of iron formed by the action of organic acids on soils. The deposition of the ore in the form of pellets cannot possibly take place except where the water is stagnant. The presence of this material thus indicates that there is not sufficient drainage. This want of circulation of water, though probably due as much to the clayey nature of the soil as to its topography, would be greatly obviated by proper drainage.

SUMMARY.

From a personal knowledge of the site and the results of the analysis of the various samples of soil the necessity for efficient drainage is very forcibly emphasized, and that more especially in the low-lying plateau—the strip between the telegraph line and the high level furrow which cuts along the ridges to the north-east of the former. Of this belt of "brak" soil Holes Nos. 3, 5, and 7 are representative and practically define the "brak" area. Hole No. 5 may be considered the centre of the "seat of infection," the quantity of brack salts (common salt chiefly) being quite excessive. These salts are also noticeable and appear to extend over the surrounding area up to Holes Nos. 4 and 6 and the other side of the telegraph line; but are more pronounced towards Hole No. 7.

It is absolutely necessary that the above area should be well drained to prevent a further rising and accumulation of the injurious brack salts in the soil.

It is only in Holes Nos. 6, 8, and 9 that the most injurious of all alkali salts (sodium carbonate) is present, fortunately the amount is not alarming, but here too the necessity for drainage must be borne in mind.

It is essential that the physical texture of the soil be improved by drainage, cultivation, and the use of lime. *A dressing of the latter is very necessary in view of the low ratio of lime to magnesia in the Kopjes soils.* From 200 to 400 lb. of lime dressing to an acre before ploughing or before harrowing would be very beneficial in improving the soil texture.

Potash and phosphoric oxide especially should be supplied at once, for there are apparently no reserves of these plant food constituents available in the soils even down to the second foot.

In the area surrounding Hole No. 4 a potash manure is even more necessary. Kraal manure would be possibly the most beneficial and economical.

To make good the deficiency of phosphoric oxide, I would suggest the use of basic slag of good quality. From 200 to 400 lb. per acre should be used, and it could be sown broadcast prior to harrowing. Owing to the varying amounts of free lime which this chemical fertilizer may contain, it should not be mixed with stable or kraal manure, as a loss of nitrogen would then result. The application should therefore be made either not less than a fortnight before or later than that of farmyard manure.

ROODEPOORT SCHEME.

With regard to the soils taken from this settlement it is quite evident that proper drainage is absolutely essential. Sample No. 38, which is typical of the bulk of the soil not under cultivation as yet on the plateau below the dam, contains quite an excessive amount of "brak" salts, so much so that, unless proper drainage is made, the soil will in a comparatively short time give very discouraging results. The soils are, on the whole, very much richer in potash, but with the exception of Sample No. 39 (a very good all round soil) they all need a dressing of basic slag in the quantity suggested for the Kopjes soils.

In order to test the quality of the water supply, available samples of borehole and river water from the Kopjes area were procured by me at the time of my visit and analysed, yielding the following results, stated in grains per gallon:—

	From borehole.	From river.
Total solids	21·70	15·00
Chlorine	1·77	·71
Carbon dioxide (as sodium carbonate) ...	17·90	15·40
Sulphates	little	little
Lime	traces	traces
Magnesia	traces	traces

These waters are therefore suitable for irrigation purposes, provided the soil drainage is reasonably good.

The Preparation and the Use of Starters in Buttermaking and Cheesemaking.

By James B. Fisher, N.D.D., Lecturer in Dairying, Government Experimental Farm, Potchefstroom.

Starters should be used in all dairies nowadays in the manufacture of butter and cheese, at any rate where either of the products are turned out on anything like a large scale. In these days of keen competition the very best article that can be manufactured must be made, and this can only be attained by the use of a pure culture starter.

A tremendous amount of bad butter is made on farms in South Africa just now; also a great deal of bad cream is sent to factories from farms where butter is not made—the reason for this being chiefly the lack of cleanliness, together with lack of knowledge in the treating of cream and the making of butter. All utensils which come in contact with milk or cream should have been previously sterilized by the use of boiling water or steam after having been well washed with lukewarm water. Enamelled buckets should be used in preference to steel buckets. Churning should be performed at least every two days in summer and three to four days in winter. Cream hot from separator should be cooled down immediately and not mixed with older cream until it is quite cold. A better way is to cool down the cream after each separating, and keep each lot separate till within twelve to eighteen hours of churning, then mix the lot and add a starter prepared in any of the three ways mentioned below; but it is no use attempting to make use of a starter unless absolute cleanliness is enforced. It is keeping the cream at a high temperature whilst ripening that is the cause of so much bad-flavoured butter, and the bad flavours are caused by dirt, which is made up of countless numbers of germs, and by cooling the cream you hinder or retard the growth of these germs.

We will take the preparation of a starter for the ripening or souring of cream to begin with.

Cream may be ripened in three ways:

1. Ripening under natural conditions.
2. By the use of a natural or home-made starter.
3. By the use of a pure culture starter.

No. 1 is for small or limited amounts of cream, and consists of allowing the cream to sour naturally, the temperature only being regulated. Perhaps the best temperature to keep cream at would be anything between 60° F. and 68° F. The lower the temperature the longer the cream has to be kept. Ripening may be hastened in the winter by raising the temperature to 80° F. or 90° F. twenty-four hours before churning, and allowing it to cool down by itself.

No. 2.—Natural or Home-made Starter.

Starters of this kind are sour milk, buttermilk, and whey. The best of the three mentioned is sour milk, made in the following manner, viz.:—

First, select a cow that you know gives good, clean, healthy milk. Milk some into a sterilized bucket, cover with a sterilized muslin,

and keep at a temperature of 70° F. until partly coagulated. Next pasteurize some separated milk by heating it to 185° F. for twenty minutes. Take about one gallon of this milk and add to it some of the previously soured milk (use enamelled buckets for preference), and keep at 70° F. Repeat this inoculating process for three or four days, when you will have practically a pure culture starter. Scrupulous cleanliness must at all times be recognized in dealing with starters. Buttermilk is sometimes used, also whey is used in cheese-making, but unless they are from good previous stock they should not be used on account of their imparting bad flavour, etc., to the cream or milk to which they are added.

No. 3.—Pure Culture Starters.

A pure culture consists of lactic acid bacteria only, the lactic acid bacillus being the one and only germ essential for the souring of cream. The flavour, aroma, and good keeping qualities of butter are also dependent on the presence of this germ. Milk by the time it arrives at the byre or cow-house is heavily laden with many different kinds of germs which are deleterious to the keeping qualities of butter, and by allowing milk or cream to sour naturally in the dairy you are allowing these bad flavours and disease-producing germs to gain the ascendency, which they will do, as they predominate in number over the lactic acid germ, which is the one needful. Therefore, by using a starter to your cream prepared in the following or foregoing methods you have an excess of the lactic acid germ over the others present.

Pure culture starters contain one special organism selected on account of its ability to produce a desired fermentation.

These cultures are to be got either in a liquid or powder form. The powder or liquid is poured into an enamelled bucket containing pasteurized separated milk and well stirred in for five or ten minutes, covered with a muslin, and kept at a uniform temperature of 60° F. to 70° F. When it is partly coagulated, inoculate more pasteurized milk at the rate of 3 to 4 per cent. in the same manner as described in the home-made starter. A starter should at no time become too curdled, but only partly, and should be distinctly acid or sour to the smell. The vigour of the germ is impaired by strong acidity; .8 per cent. acidity is too much—.65 to .67 is the desirable condition, the reason for this being that in over .8 per cent. acid the lactic acid germs cannot continue their work, and if more than that amount of acid is present the undesirable germs gain the ascendency.

If the starter is ready too soon one day it should be set at a slightly lower temperature next day, and at the same time the percentage of inoculation should be slightly reduced. If a starter is used by an experienced person (and only experience teaches) and carefully propagated from day to day, it can be kept up to its required strength and purity for a long time. On no account should a dairyman keep on using a starter which he suspects; when it shows any sign of going off flavour he should make a new one.

When your starter is ready for use, which will be about four days after the first propagation, take the cream and pasteurize it, which can be done in two ways.

First, by passing it in a continuous flow over a pasteurizing machine at a temperature of about 175° F. This method is for unlimited amounts of cream, such as in factories. No. 2 method is for small dairies, and consists of immersing the can of cream in water hot

enough to keep the cream at a temperature of 160° F. for fifteen to twenty minutes, the object in both cases being to kill all growing germs in the cream before adding the starter. The cream is now cooled quickly to about 65° F. to 68° F. Starter at the rate of from 3 to 4 per cent. is added to a sterilized bucket, and the cream added to this and well stirred. This is the amount to be used for cream giving a test of from 25 to 30 per cent. of butter-fat. For richer cream you would increase the amount of starter, as rich and thick cream takes longer to ripen than does thin cream. It is always necessary to take off the top layer of the starter before using it, and throw it away, as it contains dust particles, etc.

Now we come to the use of starters in cheese-making, and one has to be very much more careful here. To begin with, milk to be used in the manufacture of cheese-making cannot be pasteurized as can cream, on account of the difficulty of the milk coagulating once it has been heated. Therein lies the difficulty of farmers in this country making more cheese than the milk from the cows on their own farms will allow. Milk has to be bought from neighbouring farms, and arrives in all conditions, and to be successful in cheese-making you must start off with absolutely sweet, clean milk, as the final product depends entirely on the number and kind of germs present at the commencement of the operations. The starter is added to the mixture of evening's and morning's milk at the rate of 0.2 to 0.5 per cent., and should be strained through a cloth. The idea in cheese-making is the same as in butter-making, viz., to give the lactic acid germ the ascendency so as to keep other deleterious germs in the minority. Too much starter must on no account be used, as the cheese will, metaphorically speaking, "run away with you," as the chief end to attain is to have the right amount of acidity or sourness at the end of a given time. Time and acidity must work hand in hand to give the best results.

Agricultural Tour in the United States and Canada.

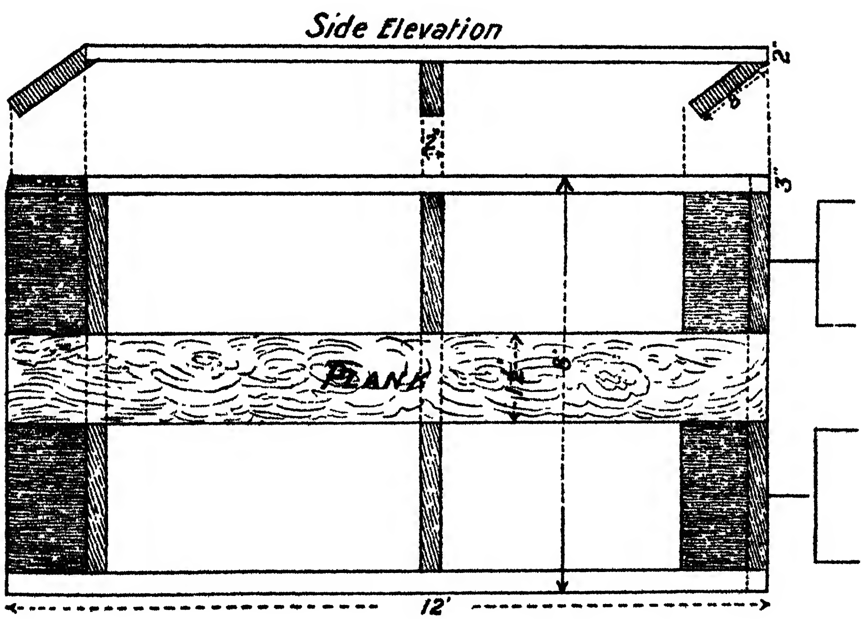
By A. M. Bosman, B.S.A.

(*Continued.*)

Mitchell, Nebraska.

At Mitchell is situated the Irrigation Experimental Station, under the direction of Mr. Knorr. He also conducts dry-farming experiments on one part of the farm so as to compare the results with those obtained on the irrigated plots, both with regard to yield and quality.

Levelling the land as far as possible is essential for irrigation work. For this purpose a road leveller and a float is used; the float is home-made (see drawing): it is made out of wood, and the plank on



top is used by the driver to walk back and forward on, so as to weight the float at the right place over the knolls. Four mules are required to draw this.

Cement sluices are used and are more economical and more lasting than any other kind.

The potatoes are not irrigated before flowering unless it is absolutely necessary to do so. Grain is irrigated for the first time at the time it comes in boot.

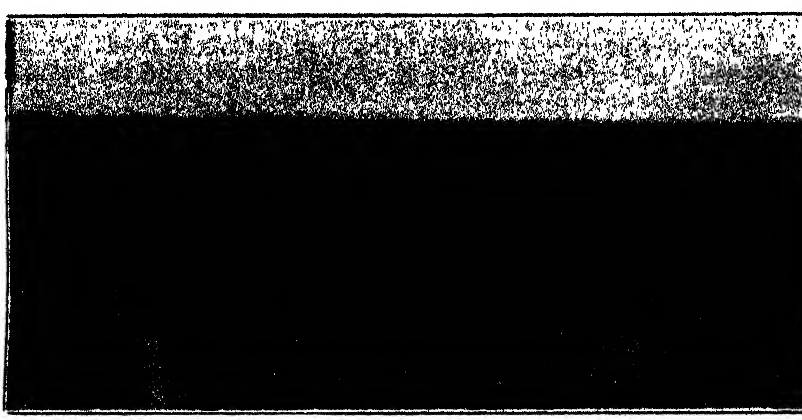
Wyoming.

At Cheyenne, Senator Carpenter and Mr. Watson, the Director of the State Dry Farms, took us for a 100 miles trip to show us the dry-farming section of Wyoming.

Rye is one of the commonly grown crops and gives some very good yields.

It is often stated that although it is better practice to leave broken sod to lie for the first year, if a crop is to be had, flax is the best that can be sown, even if it is hard on a soil so far as fertility is concerned.

Alfalfa (lucerne), in cultivated rows 40 inches apart, sown at the rate of 2½ lb. per acre, does very well for seed production; the picture following shows such a field in bloom. The plants are 6 inches apart in the rows and these are planted from north to south, so as to allow the sun to get on both sides of the rows; this causes an even fertilization of



Irrigated Potatoes.

the flowers all over this bushy plant, as both heat and the work of insects causes the alfalfa flower to "spring" and thus fertilize itself.

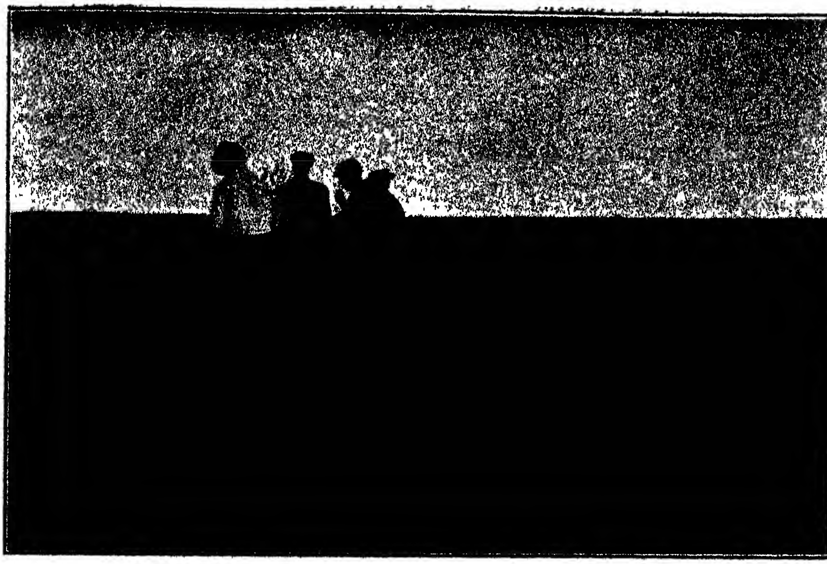
We also passed very many large and good fields of wheat; a number of fields are sown in what is called sections, i.e. a field of one square mile. It is all steam ploughed, and it is one of the prettiest sights to see mile-square fields extending over the whole landscape.

Dry farming at Laramie, as far as I could see, was a miserable failure; the soil is very shallow with a gravel sub-soil, and besides where irrigation is resorted to they are troubled with white alkali, even on high lands. Drainage is a last resort, but it is too expensive for such lands.

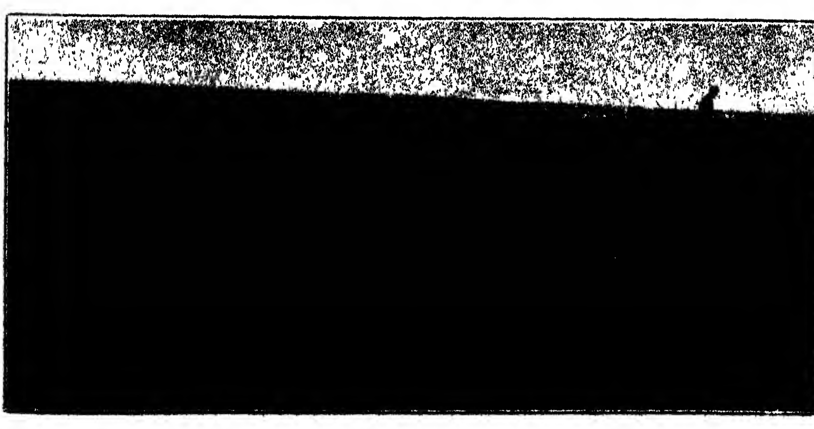
Montana.

Dry farming has found great favour in Montana. We visited Bozeman and obtained some very useful information.

The varieties of wheats most commonly grown are Turkey Red, Crail Fife, and Kherkov. Oats are the Swedish Select, Sixty-day, and Kherson.



Dry-land Rye, sown on sod and old land at rate of 16 lb. per acre.



Dry-land Alfalfa in cultivated rows 40 inches apart, sown at the rate of 2½ lb. per acre.

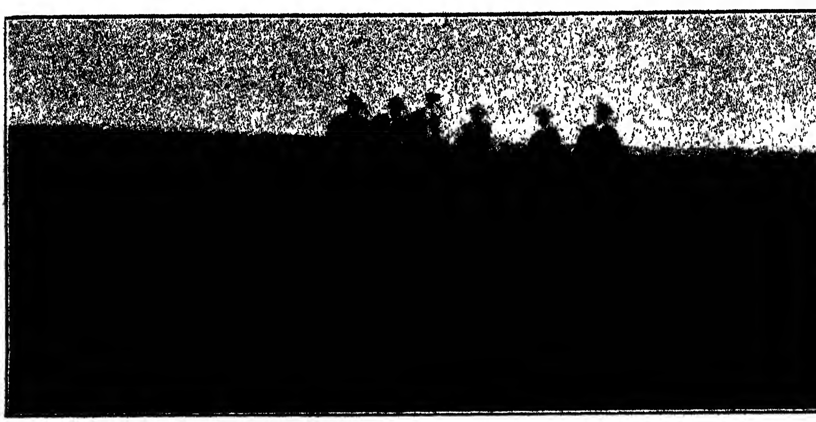
Plate No. XLI.

These were all the places I visited with regard to dry farming, and I do not think it is out of place to give here a very brief review of the methods observed in the dry-farming practice.

Although the conservation of moisture is the first essential of successful dry farming, the fertilization of the soil should not be neglected. Know your soil and know, as far as possible, what it would produce if it had sufficient moisture.

In arid regions the sub-soil is more porous and therefore more capable of supporting plant life than the more inert sub-soils of humid regions. The arid farmer need, therefore, have no fear of turning up too much sub-soil.

If a soil is not continuous—i.e. if there are layers of rocks, marl deposits, gravel seams, etc.—the water is hindered from rising and such a soil is, therefore, undesirable for dry farming. The main point in judging a prospective dry farm, as Dr. Widtsoe gives it, are "depth of soil, uniformity of soil to a depth of 10 feet, growth and



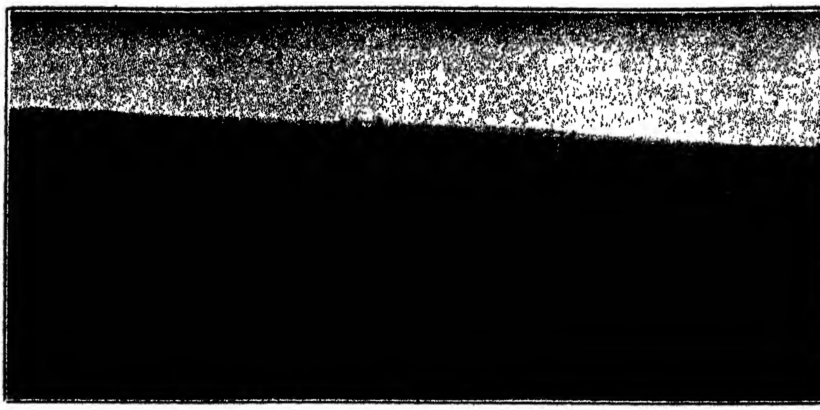
A Sea of Dry-land Wheat (640 acres).

kind of native vegetation, climatic conditions relating to early and late frosts, the kinds and yields of crops that have been grown in the neighbourhood, the total annual rainfall," and, I should add, the evaporation, for, from this, we can get approximately the net annual rainfall.

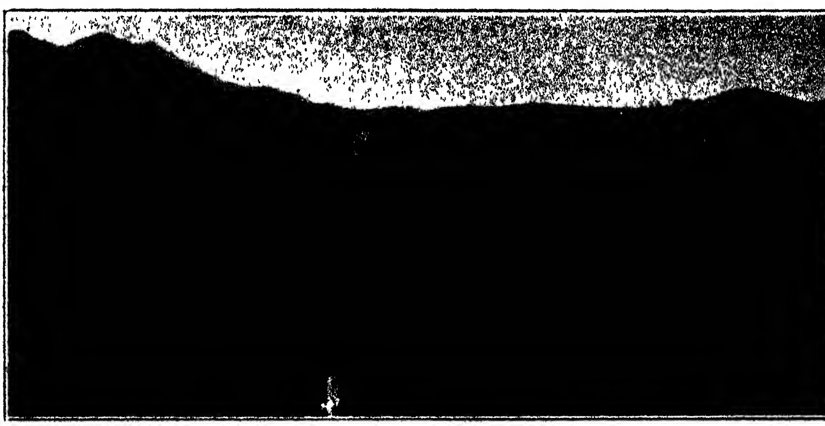
In choosing a crop choose one that has proven itself to do well on dry farms, and of course choose a "dry" variety, which should be drought resistant, quick maturing, and deep rooting.

The selection of good, well matured seed of good vitality is essential. Proper seeding, tilling, and harvesting should then be observed. The ground should not be sown too thickly with grain because there is only a certain amount of available soil moisture; if then the plants come up too thickly they cannot develop properly because of insufficient moisture; in such a case it would prove of advantage to go over the field with a harrow with the teeth slanting backwards so as to pull out some plants and at the same time form a moisture-protecting mulch on top.

In arid regions the roots go straight down towards the water and therefore deep cultivation between the rows of any hoed crop would not



Summer Fallowing a Field (a woman driving).



Dry-land Oats(Sixty-day). Yield, 70 bushels per acre.

Dry-land Wheat (Kherkov). Yield, 42 bushels per acre.

Plate No. XLII.

hurt its roots. By this means the roots are all the better protected against the drying influences of the sun and winds and long droughts.

Successful dry farming is governed very largely by the success of storing the annual rainfall in the soil until it is needed. In countries where the seasonal rainfall is irregular and the run-off is great, the farmer should prepare his soil very deeply, by deep ploughing and sub-soiling if possible. The moisture can then enter quickly and be held there. It is true that, because of the packing which occurs during heavy rains, the run-off cannot be prevented, but vegetation (which holds the rain for a while) assisted by deep ploughing would give the well-prepared soil more time to absorb the moisture. Besides, in warm countries and where there is summer precipitation, the moisture will have to be guarded very closely by deep cultivation, as evaporation is much greater during the summer months.

Ploughing after harvest has proved to be a great moisture-saving practice, and on sloping land, if it is ploughed along the contours, the run-off will be prevented to a great extent. There is no reason why dry farming on the right soil with the right kind of seed and with good methods should not be a success in South Africa; we get the rain and should be able to prepare the soil to receive the rain and conserve the moisture for the sole use of the crop growing on the field.

Wyoming and Montana contain some of the largest sheep ranches in America. The sheep are pastured all the year round and are continually being put on to new pasture; only very occasionally, in bad winters, do the farmers draw hay for the sheep. All through these flocks there is a decided strain of Merino blood, for, although it does not make the best type of mutton sheep, yet as far as hardiness and flocking characteristics are concerned the Merino blood is invaluable.

Very little attempt is made on these ranches to produce pure-bred stock, they are mostly grades; a favourite cross is the Merino and Cheviot; the Oxford Down has also been tried with the Merino and with much success for those western conditions.

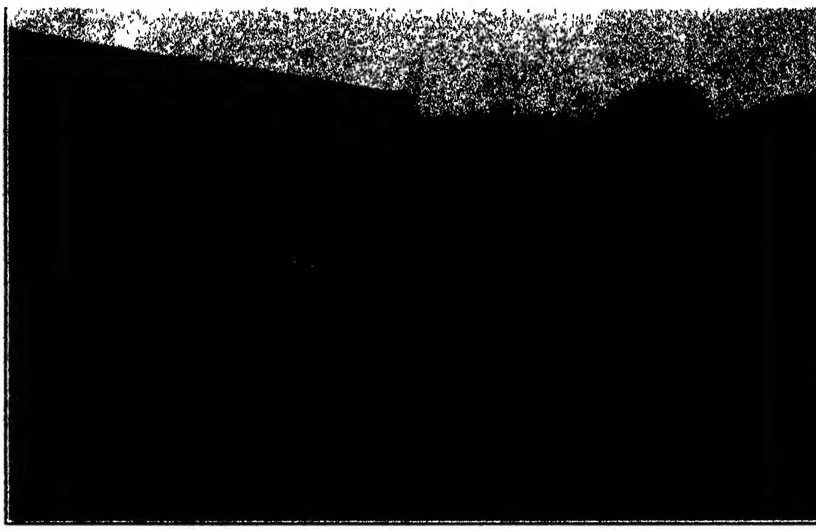
From Montana State we passed into the provinces of Alberta and British Columbia, chiefly with the object of attending the Western Canada Irrigation Congress and of getting as much information as we possibly could in so short a time. I had only a few hours in Lethbridge, so I spent my time interviewing Mr. Burns, the Secretary for the International Dry-farming Congress; from him I got some very useful information regarding the progress of dry-farming in all countries.

WESTERN CANADA.—IRRIGATION CONVENTION.

At Kelowna, on Lake Okanagan, we were received very cordially. The speeches on irrigation matters were very instructive indeed—they were delivered by such men as the Honourable Ross (Minister of Lands), the Honourable Price Ellison (Minister of Agriculture), Dr. Fortier and Professor Atkinson from Montana.

On two occasions we went on excursions to see various irrigation schemes; there were many extensive irrigation plants in operation, some siphoned streams, some open cement ditches, and some overhead galvanized iron or wooden ditches. There is also a large reserve reservoir, which holds a great quantity of water which can be used in case of insufficient supply from the regular stream; it is also fitted with an alarm clock which rings as soon as the overflow exceeds a certain amount.

I shall not attempt to give a summary of all the valuable lectures, as each one can be found in the annual report of the convention. Throughout the whole convention, however, one point was strongly emphasized, namely, that it is not so much a question of how much water one can get on the land, but how little one can do with; in other



Excursion to see Irrigation Plants.

Reserve Reservoir.

words, over-irrigation is worse than under-irrigation, for, not only do you rob your neighbour of his share, but you injure your own crop and soil, producing shallow rooting and therefore poor crops of poor quality, also souring your land and exposing it to the danger of becoming alkaline.

The rainfall should be taken account of, the ground tested for moisture, the amount of water put on should be known, and (as Mr. Burns pointed out), in addition to taking these steps, cultivation is just as important and just as much required on irrigated land as it is on dry land.

Open Cement Ditch.

CALIFORNIA.

I visited the following places in California:—

1. Agricultural College, at *Berkeley*, for general information.
2. *San Jose*, for the prune industry, both in the orchard and the drying yards.
3. *Los Angeles and Riverside*, for the citrus industry in the orchard and packing-houses, and also for the purpose of gleaning information regarding irrigation schemes.
4. *Fresno*, for the vineyards and raisin industry.
5. *Chico*, to see the Government Introduction Station where plants from all over the world are grown.

I also paid a certain amount of attention to the various Chambers of Commerce and to the great Co-operative Californian Fruit Exchange.

No attempt has been made to go fully into the Californian industries; I have merely outlined the course that I followed in investigating these. I was more particularly anxious to discuss the dry-farming observations I have made during my travels.

Wheat Experiments at the Experimental Farm, Potchefstroom.

By T. O. BELL, B.A., Lecturer in Botany.

DURING the last few years many varieties of wheat have been grown and tested here as a winter crop under irrigation. A large number of these have been discarded after a year or two's trial, either because they were obviously unsuitable or because other very similar varieties gave better results in point of yield. In all cases these wheats have been drilled in with an ordinary seed drill, the drills being 8 inches apart. The varieties have been sown in long narrow parallel strips across the field so as to make the conditions for each as similar as possible. As regards the time of seeding, this is dependent here on two factors. If the crop is sown too early it is in danger of being destroyed by a late frost occurring after the crop is in ear. On the other hand, if left too late, the crop may become badly rusted. The happy medium for most of the varieties for this district appears to be about the middle of June; even the earliest varieties sown at this time are not forward enough to be injured by any ordinary late frost, and they still ripen before there is much chance of damage from rust. The late winter varieties, such as Red Fife, etc., should, of course, be sown earlier.

The varieties tested have naturally differed immensely, not only in point of yield, but also in other characters, such as quality of grain, rust resistance, etc., and it is the object of this article to bring out these points of difference between the different varieties. It must be clearly understood that these wheats were always irrigated, and it must not be assumed that the varieties would occupy the same relative positions if grown on dry land.

These trials were really started in 1907. Before this a few varieties had been tried, but mostly just local wheats and late winter wheat. Since that year they have been continued each year. Fresh varieties are constantly being introduced into the tests, and of course

some are discarded each year—some on account of general unsuitability, others because, although they may be giving satisfactory results, nevertheless seem inferior to some other very similar variety, and of course it is impossible to test every obtainable variety yearly. The number has to be kept down to reasonable proportions by retaining only the best of several similar varieties. Nine varieties have been grown continuously from 1907 onwards, giving six crops of each. These results are embodied in the following table, the varieties being placed in the order of their average yield for the whole six years:—

VARIETY TRIALS (WHEAT).

VARIETIES (in order of yield).	CHARACTER.	MATURATION.	Weight of Grain per Bushel, average.	YIELD OF GRAIN PER ACRE (IN LB.).						AVERAGE OF 6 YEARS.	
				1907.	1908.	1909.	1910.	1911.	1912.		
			lb.							lb.	bags.
1. Egyptian Red ...	Small, bearded, brown-purple ears	Medium Early	65	1240	2200	2160	2424	1920	1236	1864	9·32
2. Fourie	Long, bearded, white ears	Early	66	2240	1800	2100	1766	1710	1272	1812	9·06
3. Australian ...	Beardless, white ears	Early	67	2160	2350	2020	1830	1450	1000	1800	9·0
4. Glujas Early ...	Beardless, red-brown ears	Early	66½	2240	1600	1980	2006	1640	1240	1782	8·91
5. Spring	Bearded, brownish ears	Early	66	2240	1850	1610	2000	1750	980	1740	8·7
6. Potchefstroom White	Beardless, white ears	Early	65½	1920	2200	1340	1360	2030	1206	1675	8·4
7. Beloturka ...	Durum, bearded, yellowish-brown ears	Medium Early	65½	1920	1850	1255	2020	1800	980	1640	8·2
8. Medeah... ...	Durum, bearded, black ears	Medium Early	65	1440	1850	1500	2290	1410	1020	1589	7·95
9. Caledon Baard...	Bearded, lax, white ears	Early	65½	2320	2000	945	1650	1760	890	1580	7·9

The *Egyptian Red*, which heads the list, would have a still bigger lead were it not for the poor results it gave in its first year of trial here before it was properly acclimatized. Unfortunately, however, while it is undoubtedly a fine cropper, and more rust-resistant than most, the grain is of very poor quality.

In the case of Australian, which takes third place on the six years' average, though it has not done quite so well for the last year or two, the grain is white and large and of splendid quality, producing a flour which, for ordinary purposes, is second to none.

Australian does not do so well in a droughty season as some of the other varieties.

Fourie, which has done consistently well, is a fine strawed, bearded variety producing white, medium-sized, long-berried grain of good quality for milling purposes. This, and the following variety, are more resistant to drought than the average.

Glujas Early has fine straw with red-brown ears. It produces a good sample of long-berried grain inclined to a yellowish colour.

Spring is a bearded variety with fine straw and produces a red grain of good quality.

Potchefstroom White is a variety having good fine straw. Its ears are beardless and very compact. It produces a white grain of excellent quality. Does well under varied conditions.

The following table shows all the varieties which have been grown during the last three seasons with their yearly yields and average:—

Variety.	1910. lb.	1911. lb.	1912. lb.	Average 3 years. lb.
Egyptian Red	2420	1920	1236	1860
Glujas Early	2000	1640	1242	1628
Beloturka	2020	1800	980	1600
Fourie	1760	1710	1272	1581
Spring	2000	1760	980	1576
Medeah	2290	1410	1020	1573
Potchefstroom White	1360	2030	1206	1532
Standerton Winter	2106	1680	800	1530
Rooi Wol Koren	1830	1680	980	1500
Bombay	1910	1520	1000	1477
Hawkesbury	1970	1410	1032	1471
Australian	1830	1450	1000	1427
Grimbeck's Klein Koren	1630	1530	1116	1422
Caledon Baard	1650	1670	890	1403
Ekstein	1540	1420	1092	1351
Wit Klein Koren	1590	1550	—	—
Holstrooi	1760	—	—	—
Bobs	1700	—	—	—
Kolben	—	2200	1140	—
Durum Theunissen	—	2000	1152	—
Apulia	—	1550	960	—
Sebritz	—	1390	1212	—
Square	—	1390	—	—
Red Fife	—	1220	—	—
French	—	1200	—	—

The very low yield of some of the varieties in 1909 was due to frost. A very late frost occurred on 27th September of this year and all of the earlier varieties were more or less "frosted." Wit Klein Koren, Ekstein, Wit Wol Koren, Caledon Baard, etc., in particular, were badly affected.

In 1910, owing to heavy rains in October, a certain amount of rust was present in most of the varieties, though not sufficient to make much, if any, difference in the yields. Holstrooi and Rooi Wol Koren showed themselves particularly susceptible to the disease, and Bobs, which had a reputation for rust-resistance in Australia, was no better in this respect than the average. This season also was more favourable for the late varieties than the early ones, as water for irrigation purposes was very scarce during the growing season and the rains in October were too late to benefit the early varieties but were very useful to the late ones.

1911 was a fair season, though irrigation water was not as plentiful as it might have been.

In 1912, however, the whole crop suffered severely from drought through lack of irrigation water and total absence of rains. All the varieties were more or less seriously affected, and the yields of all materially reduced.

An interesting experiment was tried in conjunction with the 1911 trials. The land devoted to these trials had previously borne a variety of crops sown in strips. The varieties of wheat were sown across these strips so that the soil conditions should be the same for all. This is shown in the accompanying diagram:—

C

A	LINSEED.	SUN-FLOWERS.	VARIOUS LEGUMES, SOY-BEANS, COW-PEAS, EDIBLE PEAS, ETC.	TOBACCO.	MAIZE.	B

D

The preceding crops, maize, tobacco, etc., had been sown in strips running from C to D. The varieties of wheat were sown in long narrow strips running from A to B. Thus each variety of wheat had similar conditions.

The difference in the growth of the wheats on the ground previously bearing various crops was most marked, even without weighing the produce, but when the crop was harvested and weighed, two of the varieties—Durum Theunissen and Beloturka—were harvested in sections corresponding to the preceding crop and weighed separately. This gave the relative yield of wheat after the various crops previously occupying the ground, and averaged for the two varieties and worked out to acre yields, it is as follows:—

On land previously bearing		legumes	2460	lb. per acre.
,,	,,	maize...	1550	,,
,,	,,	tobacco	1250	,,
,,	,,	sunflowers ...	1045	,,
,,	,,	linseed	825	,,

These figures, of course, refer to the grain only. The differences in the amount of straw were quite as marked.

This shows very clearly the value of legumes for improving the soil. In this case a crop of the legumes was taken off and only the roots and stubble ploughed in.

Linseed and sunflowers appear to be two very exhausting crops.

Several varieties have been submitted to Mr. Horsfall, of Winburg, Orange Free State, who very kindly tested and reported upon their milling properties.

From the 1909 crop the following were submitted:—

1. Wit Klein Koren.
2. Glujas Early.
3. Australian.
4. Bobs.
5. Holstrooi.
6. Red Fife.

7. Ekstein.
8. Potchefstroom White.
9. Rooi Wol Koren.
10. Fourie.

Mr. Horsfall summarizes his report as follows:—

"The best samples are:—

"1. Australian; a good first.
"2. Potchefstroom White.
"3. Glujas Early; a very close third.
"4. Fourie.
"5. Bobs.

"The rest are nowhere.

"In making this result I am not including Red Fife, as I have taken this in a class by itself, it being a glutinous wheat. The first three are exceptionally fine samples and well worth cultivating."

Of Red Fife he says:—

"If successfully developed, this quality of grain will produce a flour which eventually would displace every sack of American flour imported into this country. In this respect I am quoting it as a baker's flour, producing grain and not the usual South African meal which the housewife uses, for which purpose there is nothing better than the first three I have selected."

From the 1911 crop the following varieties were submitted:—

Wit Klein Koren.
Australian.
Glujas Early.
Standerton Winter.
Red Fife.
Rooi Wol Koren.
Potchefstroom White.
Fourie.
Egyptian Red.
Medeah.

Mr. Horsfall says in his summary—

"Taking all points into consideration, the results of the tests are:—

"1. Australian.
"2. Potchefstroom White.
"3. Glujas Early.
"4. Fourie.
"5. Rooi Wol Koren.
"6. Wit Klein Koren.
"7. Egyptian Red.
"8. Standerton Winter.

"Nos. 1, 2, and 3 are distinctly ahead of the other five varieties, and I consider the Australian to be one of the first wheats I have handled in this country, if not the first. It possesses all-round characteristics to an exceptional degree, and is an ideal wheat from a milling point of view."

Of Red Fife, which comes in a different class, Mr. Horsfall says—

"Red Fife is well worth cultivating and ought to be experimented with largely on different soils in different parts of the Union, as there is an unlimited demand for this variety of wheat, providing it can be produced true to type possessing a large percentage of gluten of good quality."

Mally Fruit Fly Remedy.

A DEMONSTRATION OF ITS APPLICABILITY IN TOWNS.

By CHAS. LOUNSBURY, Chief, Division of Entomology.

FRUIT growers in town and country alike should be interested in the following excerpt from the entomological report for February. Baiting for the fruit fly has become an established practice on some of the largest fruit farms in the Cape Province, and the Division of Entomology appears to establish its claim that the remedy is applicable to town conditions. The trouble and expense of successfully combating the pest in a town garden, surrounded by gardens in which it is allowed to work its havoc without hindrance, is vastly greater than under fruit farm conditions, but city men usually grow fruit for pleasure—not for profit—and many will no doubt avail themselves of the information that baiting is an efficient remedy when it is thoroughly and persistently practised. The Entomologist writes:—

"As mentioned in my last monthly report, Plant Inspector Hodgson began, under my supervision, about the middle of January a test of the efficacy of the 'Mally Fruit Fly Remedy' under the conditions that prevail in the city of Pretoria. I have on file letters from well-known fruit growers in the east and west of the Cape Province and in Natal testifying most convincingly to the great value of the remedy in their orchards, but several prominent Pretoria residents have informed me that they tried it last season according to the directions issued by the Division without deriving any apparent benefit. Their late peaches, they said, were practically all magotty, despite all their trouble. I did not doubt that the lack of success was due to failure to renew the bait promptly after rains or to some other fault in the use of the remedy in connection with local conditions very favourable to the pest, but I felt that it was highly advisable to prove the worth of the remedy by a successful test on late peaches in some

much-infested Pretoria garden, and thus become able to base recommendations on actual local experience. The little test which I and Mr. Hodgson carried out was, I consider, conducted under as severe conditions as are likely to be encountered in the ordinary season anywhere in the country, and I am pleased to record that the results were quite satisfactory.

"The remedy consists in the application, preferably with a garden syringe, of a small quantity of dilute arsenically poisoned syrup at frequent intervals to the trees whose fruit it is designed to protect. The poison is applied at the rate of about a pint to a tree about ten feet high and ten feet wide, and it should be renewed promptly after any rain and at least once a week to a fortnight according to the prevalence of the pest in the vicinity. The first application should be made to the earliest susceptible fruits about the time they are two-thirds developed, the later-maturing fruits should be included in the baiting as they reach this relative stage, and the baiting should be continued until the fruit is all off. The remedy acts by fatally poisoning the flies that otherwise would deposit in the fruit the eggs that develop into the well-known maggots. Where the pest is particularly prevalent it is recommended that one or more general preliminary baitings be made about October. A very few flies early in the season may become the progenitors of many hundreds late in the season, and to make sure of getting the best results from baiting for the protection of late fruits it is essential that baiting be carried on thoroughly and persistently throughout the season. But to have our demonstration test a severe one the baiting was not started until the season was well advanced.

"The garden in which the test was conducted is a private one, in which baiting was unsuccessfully practised last year. It contains a large assortment of trees, including orange, lemon, naartje, apple, pear, peach, nectarine, apricot, quince, plum, persimmon, fig, guava, and loquat trees, but there are very few of any one variety, and different kinds are more or less mixed. Much of the garden is bounded by kei apple hedges of which altogether there must be fully three hundred yards, and these hedges are in season laden with fruit which becomes infested with the pest. High-growing screens of eucalyptus, pine, and cypress trees provide abundant shelter in times of storm, and, taking everything into consideration, there is probably no other garden in Pretoria where the fly finds conditions more favourable for its welfare. The pest is not equally troublesome every year, and it is a common experience for it to be worse in one garden than in others. Hence it was considered advisable to restrict the baiting to trees in one part of the garden and make control observations on peach trees growing in another part. Driveways and outbuildings cut up the garden into several sections, and the major part of the largest of these sections consisting principally of peaches and other stone fruits was chosen for the test. The trees chosen as controls are about 150 yards distant. The baited trees are probably nearly all over ten years' old. They suffered much from last year's drought, and in consequence the fruit was neither as abundant nor as well developed as it might have been. Some trees had very little fruit and others carried principally misshapen and split fruit. Altogether fifty-seven trees were baited. They included apricots and early and mid-season peaches from which the fruit had been picked before the test began, and also a few almond, cherry, plum, guava, quince, chestnut, and walnut trees which were

baited only because they stand amongst the late peach trees. The late peach trees numbered nineteen in all, and the immediate object of the baiting was to protect the fruit borne by them.

"Eight gallons of bait were prepared for each treatment, and whatever was left over after baiting the fifty-seven trees—generally only a quart or two—was squirted on to the nearby hedges and windbreaks. The work usually took about an hour and a half. The bait consisted of—

6 lbs. brown sugar;
6 oz. arsenate of lead paste;
8 gallons water.

The proportions of the several ingredients are those which have been recommended by the Division for several years. It is likely that a sweeter bait, or one made with treacle, would be more readily taken by the flies, but I wished sugar used as it is a more convenient sweet than treacle for most South African residents to use for such a purpose, and as a sweeter bait might prove objectionable in some parts of the country by being more favourable for the growth of fumgaine, the shoot-like fungus that develops on the sweet excreta of certain insects.

"The first application was made on 16th January. At this date a few flies were seen about the trees, and maggots were seen to be already present in a few still very hard green fruits on the late varieties of peach which the baiting was designed to save. The fruit on a couple of Gladstone peach trees standing in the group of baited trees was just ripening and was considerably infested. Of fifteen fruits plucked for examination eleven were infested, and every one of thirty-two found on the ground were in like condition. Examinations earlier in the season had disclosed the pest to a slight extent in the apricots and early peaches, and altogether there was every reason to expect that the late peaches would all become infested if the baiting to be done did not suffice for their protection.

"Rain in heavy thunderstorms fell frequently during the weeks that followed. The final baiting was applied on 18th February, and the last of the fruit was gathered on 24th February. The rainfall registered at Arcadia for the period is, according to the Meteorological Division's figures, as follows:—

	Inches.			Inches.	
Jan. 16 ...	.34	(b)	Feb. 2 ...	.09	
,, 17 ...	—	(b)	,, 3 ...	.06	(b)
,, 18 ...	—		,, 4 ...	.01	
,, 19 ...	.08		,, 5 ...	.01	(b)
,, 20 ...	.46		,, 6 ...	1.56	
,, 21 ...	—	(b)	,, 7 ...	.72	(b)
,, 22 ...	—		,, 8 ...	—	(b)
,, 23 ...	.15		,, 9 ...	—	
,, 24 ...	.82	(b)	,, 10 ...	.02	
,, 25 ...	.16	(b)	,, 11 ...	—	
,, 26 ...	.18		,, 12 ...	.34	
,, 27 ...	.07	(b)	,, 13 ...	.53	(b)
,, 28 ...	.05		,, 14 ...	.38	
,, 29 ...	—		,, 15 ...	.05	
,, 30 ...	.01		,, 16 ...	.01	
,, 31 ...	—		,, 17 ...	—	
Feb. 1 ...	.31	(b)	,, 18 ...	—	(b)

the record shows the unfavourableness of the weather for the treatment. Rain fell on twenty-three of the thirty-three days between the day on which the baiting began and the day of the last baiting, but it must be acknowledged that on four or five of the twenty-three days the quantity was not worth considering. Several times heavy rain fell and washed off every trace of the bait within a few hours of the application, and on a few occasions it was impracticable to renew the bait for a day or more owing to unfavourable weather or other reason. The days on which the trees were baited are indicated by (*b*) in the table. Thirteen baitings in all were given. It will be seen that when the 1st February and 13th February baitings were applied the trees must have been unprotected for several days.

"Windfall fruit was given no attention until 5th February, up to which date there was very little. After the 5th what fell was gathered and examined for maggots every third day. The accompanying table gives the results of the examinations:—

Windfalls from Baited Trees.

	Maggotty.	Not maggotty.	Per cent. maggotty.
February 5th	44	122	26
February 8th to 24th...	273	651	29½
Total	317	773	29

"One tree was picked on the 5th, two on the 8th, one on the 12th, 15th, 16th, and 18th respectively, two on the 21st, and the remaining ten (yellow-fleshed Transvaal peaches) on the 24th. The sound fruit was used for bottling and the maggotty fruit put aside as found. The result of the sorting was as follows:—

Plucked Fruit from Baited Trees.

	Maggotty.	Not maggotty.	Per cent. maggotty.
February 5th to 21st...	273	2236	11
February 24th...	271	1442	16
Total	544	3678	13

"As already stated, control observations were made on a few peach trees in another part of the garden. There were three of these trees, and probably because they stand in deeper soil on practically level ground and get stormwater that flows from the upper part of the garden they are much larger than the baited trees. They were laden with fruit this season. Two of them are somewhat earlier than the baited trees on which observations were made, and it was observed that many of the fruits on these were already infested when the baiting was started. The third tree is thought to be of the same variety as the majority of the baited trees. The windfalls were collected on 5th February, and subsequently at intervals of about three days until all the fruit had dropped. No fruit was plucked for use for the simple reason that practically every one was maggotty when ripe. That the windfalls were nearly all infested is evident from the following tabular presentation of the results of the several examinations:—

Windfalls from Unbaited Trees.

	Tree No. 1.		Tree No. 2.		Tree No. 3.	
	Maggotty.	Not maggotty.	Maggotty.	Not maggotty.	Maggotty.	Not maggotty.
Feb. 5 ...	565	35	235	44	2	1
,, 7 ...	547	40	122	31	3	1
,, 12 ...	759	22	466	17	42	2
,, 15 ...	426	11	451	5	101	5
,, 18 ...	268	5	432	11	236	3
,, 21 ...	37	—	343	4	395	7
,, 24 ...	—	—	173	—	136	—
,, 27 ...	—	—	—	—	97	—
March 3 ...	—	—	—	—	26	—
Total ...	2602	113	2222	112	1038	19

"The percentage of infestation in the windfalls from the unbaited trees was respectively 95¾, 95¼, and 98¼, against an average of 29 for the baited trees. The distance between the baited trees and the unbaited ones on which observations were made is about 150 yards. There are peach and nectarine trees in which the pest was permitted to work without molestation in a neglected part of the garden only about 30 to 40 yards from the baited trees, but there were no suitable late peach trees there for use as controls. It is probable that flies in quest of fruit in which to lay their eggs wandered from that and other parts of the garden to the baited trees, however, and that other such flies drifted in from the gardens of two neighbouring properties which abut the plot on which the baited trees stand. Both of the neighbouring gardens contain a few early and late peaches, and it is only about 30 yards through a thin screen of eucalyptus and cypress trees to the nearest of these trees from which flies might have emanated. Inquiries were made of the occupiers of both properties to learn what the experience had been this season with the pest. At each of the places it was reported that the early fruit had been practically free of maggots and the mid-season fruit considerably infested, while the entire crop of fruit borne by the single late peach tree present was a complete loss through the pest. The ground beneath these two late trees was littered with mummified fruits where the inquiry was made, and it appeared that all of this fruit had become infested and fallen before the baited trees were picked. Both trees are considerably nearer the baited trees than are the controls.

"It is only fair to assume that the fruit of the baited trees would have been a total loss had it not been for the baiting; and therefore that, if faithfully carried out according to the directions issued by the Division, the 'Mally Fruit Fly Remedy' is applicable under town conditions even in summer rainfall areas."

Sugar-cane in South Africa.

By H. J. Choles, F.S.S., Department of Agriculture.

(*Continued from Page* 418.)

PLANTING OPERATIONS.

Propagation.—The system of propagation universally followed on sugar plantations consists of planting the canes themselves. Propagation from seed is only adopted in the production of new varieties, as has already been referred to in dealing with that subject. Practically any portion of the cane may be chosen; the great desideratum is strong buds coupled with a healthy cane.

Sometimes whole canes are used for planting. The objection to this practice, however, is that the vitality of the cane is concentrated upon but three or four of the buds in the best part of the cane, with the result that a good, even row is not secured.

The general practice is to cut the canes into lengths of four or five buds each. Many, however, especially in Natal, prefer only the tops, which are cut off when the canes are harvested for the mill. While there is perhaps little to choose between them as regards vigour of the resulting plants, the latter method possesses the advantage of being more economical, since no portion of the cane is used which could otherwise be milled. At the same time, not sufficient attention is given to the matter of selection of suitable tops. In nearly all cases this is left to the labourers, and good and bad tops are planted indiscriminately as the result. Obviously the best plants will be produced by the healthiest tops, other things being equal. The same applies to the use of whole canes cut up into sections; the healthiest-looking canes are necessary to secure the best results. Some planters prefer first ratoons for planting, while others consider that the best results are yielded by plant canes. It is generally agreed, however, that canes twelve months old—that is, before the rind has hardened—are preferable to thoroughly matured canes. So far as tops are concerned, it is held that plant canes yield better results than ratoons.

The following table, given by G. N. Sahasrabudhe, will be of assistance in estimating the number of sets required to plant a given area:—

Distance in feet between Rows and Sets.	No. of Sets per Acre.
5 × 5	1742
5 × 4½	1910
6 × 4	1815
5 × 4	2178
5 × 3½	2488
5 × 3	2904
4 × 3	3630

The distance between the sets is, of course, measured from centre to centre of the cuttings.

Where whole canes are to be cut up, an estimate can be made of the average number of sets obtained from each cane, and the division of the number of sets per acre by this number will give the approximate number of canes required per acre for planting.

Distance apart.—The rows are placed at distances varying from four to six feet apart, according to soil, the richer the soil the greater being the distance. The sets vary from two to four feet apart, calculating from centre to centre.

Time of planting.—The general time for planting sugar-cane is August to September, dependent upon the rains; it may be done, however, as late as December and January.

Lining out.—Much future inconvenience will be prevented by the regular and systematic laying out of the plantation in the first instance. An important point is perfect regularity in the rows. There are various ways of accomplishing this. One way is, after dividing up the plantation into regular fields, varying from five to twenty-five acres, to set out young wattle or other poles, and from these stretch stout twine carrying pieces of coloured rag placed at the intervals at which the holes for the cane are to be made. Coolies then follow the string with small stakes, driving one of these in at each indicating rag. After one section is done the poles are moved on to the next section. Holes are thereafter hoed out at each stake for the reception of the sets. Where furrows are preferred the strings serve as a guide for the plough.

On Mr. Wilkinson's estate in Natal, all cane rows are laid out on the level so that on cultivating between the rows with a small American plough or scarifier the animals walk on the level and not up and down hill. In mellow land the best soil, therefore, does not wash down, but rests against the cane stools. On the hillsides a furrow is first laid off through the middle of the field by flags placed by a clinometer, and parallel rows are drawn from that either way. If the lines are getting out of level, another level is run. This system permits of the cultivation being carried on with little labour.

Attention may be drawn here to the practice on many of the Natal estates of planting "up and down" the hills instead of level—that is, *around* the hills. I have, indeed, seen hill after hill planted in this fashion. The reason for the practice does not appear, and no satisfactory explanation is forthcoming, the contention being that, when steam cultivation is utilized, the rows must be run "up and down." Few estates, however, possess steam tackle. Wherever possible level furrows should be ploughed in order to lessen the risk of washing out. A field in which the furrows are run straight down the slope of the hill must necessarily suffer in heavy rains, since there is little check against the washing of the soil.

Preparing the Ground.—The land is either drilled out with the drill plough working 9 or 10 inches deep, or it is holed out in lines, the holes being made 1 foot wide, 8 to 10 inches deep, and 1½ to 2 feet long, whilst a space of from 6 to 18 inches is left between each hole.

On the Central Sugar Factory's estates at Verulam the practice in making these drills is as follows. The plough is first run along at a depth of 6 inches. It then returns along the same furrow, with an added cut of 4 inches, making 10 inches in all. Naturally some earth falls into the bottom of the furrow—to about 4 inches' depth—and

this means that the seed canes have a nice bed of loose earth all round them in which to germinate, instead of the hard sides which the holing system of planting is liable to provide.

In some of the southern districts of Natal a furrow is made, for planting purposes, by means of the hoe, in preference to holes. On this subject a Natal sugar-planter of considerable experience wrote some years ago in the *Natal Advertiser*:—This hoe furrow "is made by the coolies working on each side of the row, first cutting out half the V and then moving over to the other side and taking out the other half. I do not see any advantage in this over holing; certainly there can be none in the matter of cost, and I consider the hole possesses many advantages over the hoe furrow. In a hole the young plant is protected from the hot sun by the straight sides of the hole, and gets that protection, if the hole is the right depth, until it is strong enough to hold its own. Again, the hole prevents anything like wash of the land in case of heavy rains. The hoe furrow allows the sun to have full play on the plants, and they must suffer in case of dry times following on the planting, and the 'stops' in the hoe furrow are not near enough together to prevent wash during heavy rains. Another objection of these furrows, to my mind, is that the cane is not got in the requisite depth; at least I have not seen any hoe furrows which are deep enough, or anything like as deep as an ordinary cane hole. Altogether I do not like them." The question of washing is, of course, got over by the running of the furrows level as Mr. Wilkinson does. Moreover, if furrows instead of holes are to be made for planting purposes, the use of a hillside plough is certainly more economical than hand work.

Which is the better system to adopt for planting—holes or furrows (ploughed)—is a moot point. The question depends upon local conditions—state of the soil (whether recently cleared bush land containing tree and palm stumps), labour available, etc.

Planting.—The cuttings are laid, two, three, or four together, in the holes. The number depends upon the condition of the sets. In the case of good, sound cuttings, two will suffice; these are laid parallel at equal distances from the sides of the hole. In the case of a poor cane, when four cuttings may be required, these should be placed in the form of a square in the hole. (Three cuttings would similarly occupy three sides of a square.)

When furrows are used instead of holes for the reception of the sets, there are various ways of disposing the cuttings. One method is to place the cuttings end on end, with a little space between each, in a continuous line. Or they may be allowed to overlap each other in a zigzag fashion. Another plan is to place them side by side obliquely to the line of the furrow. Still another method is to dispose them in sets of two or three at intervals as when holes are used. In this case, if the furrow is not sufficiently deep for subsequent banking-up (9 or 10 inches), holes are made in the bottom at the requisite distances.

At Verulam the canes, which are usually about 5 feet long, are cut in halves and planted lengthwise in the furrow in two parallel lines. In the case of each halved cane, the butt end of the one half is placed along side the top end of the other, the idea being to secure as even a row of plants as possible. The cuttings are run on continuously, or with a space of 6 inches at most between the end of one set and the beginning of the next.

It is better policy to plant too heavily than too thinly, as plants can always be cut out if necessary, whereas in the latter case the occurrence of gaps entails extra labour in filling them up with new cuttings, an operation that can rarely be performed without disturbing the established plants.

The method of planting cane sets on the Leeward Islands estates is peculiar. The sets are first of all distributed at the proper distance all over the field. Then a man proceeds along the rows with a crowbar, according to Sahasrabudhe, with which he makes a slanting hole in the ground; he then puts the set in the hole, and presses it with his foot, so that most of the set is buried in the ground. The angle which the planted set makes with the ground would appear to be not quite 45 degrees. It seems that at the time of planting in the Leeward Islands the surface soil is usually dry and the set has to be planted sufficiently deep to ensure its getting enough moisture for germination and to protect it from the scorching rays of the sun until the young plant appears. When planting has to be done in dry weather it might be found advantageous to adopt this system in South Africa. It is, at least, worthy of a trial. In Natal, where tops are generally planted, the practice is to cover them completely with soil. In dry conditions this should be deep enough to prevent possible drying out.

"The natives of Bengal have a peculiar method, which is often adopted by the Europeans there. This consists in burying the cane-cuttings in a pit until they sprout, when they are carefully removed and planted out in the fields. In placing them in the pit, great care is taken to have them in regular layers, with wet straw and a little mould between the layers; and the most delicate manipulation is needed in removing them, or the white and tender shoots will be broken off. It is a useful way of keeping cuttings over for a time when waiting for the fields to be ready for planting, and plants succeed very well when set out in moist hot ground: but they are quite unfit to be transferred to cold damp situations, or even to hot land which is also dry." (*Newlands.*)

After the cuttings are laid in the holes or trenches, they are loosely covered with about an inch of soil. As the young shoots grow up, the covering of soil is increased until the holes or drills are filled. This banking process may be continued for a time in order to assist the plants in retaining an upright position.

On Mr. Wilkinson's estate, after the land has been first ploughed with a hillside plough, it is harrowed, lined off, and small furrows 4 feet 6 inches apart, in which maize is sown, are ploughed. When the maize is up to 2 or 3 feet peas are drilled in between the rows. When the maize is off the plough is run along the maize lines, or, if the pea vines are so thick as to choke the plough, cane holes are made with hoes. The depth of furrow or hole, or hole made in the furrow, is 9 to 10 inches. Two or three cane plants are put in each hole, which is 2 feet long; the holes are 2 feet apart from end to end. When the cane comes up it is hand-weeded and hand-hoed till it is 2 feet high. It is then cultivated with horse-hoes and scarifiers as long as the animals can get between the lines.

On the Tongaat Estates scarifying is commenced as soon as planting has been done in order to keep down the weeds until the foliage of the cane shades the ground. The same practice is followed with

ratoons. This has the advantage also of conserving moisture in the soil, and so gives the young plants a good start.

WEEDING AND TRASHING.

Cultivation of the crop proceeds, for the purpose of keeping down weeds, until the cane has grown sufficiently to cover the ground. Later on, trashing may be done, although it is not carried out by some planters, whilst its practice also depends upon the labour available.

By trashing is meant the stripping off of the dead leaves, leaving them to rot on the ground between the rows of cane. It is an operation that is regarded in most cane-growing countries as necessary, in order to admit air and sunshine, which latter is considered essential in the promotion of sugar formation. In Natal opinion as to the value of trashing is divided, the operation being held by some planters to be unnecessary, whilst others perform the stripping with the aid of fire, the trash being simply burned off the canes as they stand. As might be expected, however, the central mills strongly condemn this practice owing to its deteriorating effect upon the working quality of the juice. The most experienced Natal planters and estate managers do not consider that trashing should be done, except at the time of cutting, the idea being that the practice tends to dry out the cane, whilst it has also been observed to lower the purity of the juice, thicken the rind of the cane, and increase the percentage of colouring matter in the juice.

Where sufficient labour can be obtained, trashing should be done on the fields as the cane is cut, as in this way the soil is covered with the dead leaves which provide a mulch and so check evaporation. It is also claimed for the practice that it deprives noxious insects of a breeding ground, and that the expense incurred in the stripping may be more than compensated for by an increased output of cane. In any case, in the conditions prevailing in Natal, it is not advisable to trash until within a week before harvesting on account of the danger of damage by frosts.

Some experiments were carried out a few years ago by Mr. T. Murakami, B.Sc., of Formosa, with a view to investigating this problem of trashing. In these experiments* each variety plot was divided into two parts, from one of which all the dead leaves were twice carefully stripped off at intervals of a month, while the other was left untouched, both being subjected to the same conditions of cultivation. At the beginning of the milling season in December, each plot was cut, weighed carefully, and the products analysed.

The effects of stripping on the various species experimented upon, as compared with the unstripped plots, are summarized by the author as follows:—

1. In each variety of cane the size of stalk was remarkably increased.

2. With the exception of the *Ancha* (scarlet cane) and the striped Singapore, both of them scarlet in colour, the cane stalks were found to be standing much more erect.

3. In all the varieties, except the two Formosan species *Tekucha* (bamboo cane) and *Ancha* and probably the striped Singapore (all of

* *Int. Sugar Journal*, 1908.

which are hard-rind canes), the water content and the rate of absorption of mineral salts were greatly increased, and in the juice the purity coefficient was noticeably lowered.

4. But less sucrose and more glucose are found contained in the juice from stripped canes, except in the case of the *Ancha* and *Tekucha*, in which the effect seems rather the opposite one.

5. Fibre and non-sugar organisms are markedly increased and seem to have influenced a decrease in the content of juice.

6. *Rocha* (waxy cane), *Aveha*, and striped Singapore gave a smaller tonnage, but in the other varieties it was increased by stripping, especially in the case of *Tekucha*, where the difference was considerable.

7. The amount of available sugar in the cane is greater (excepting Tekucha), ranging from 269 lb. to 653 lb. per acre.

Mr. Murakami then raises the question as to whether different fertilizers would alter these results. To obtain light upon this interesting point he arranged a series of manurial experiments in conjunction with stripping. In his article above referred to, he observes that, upon comparison with the conclusions obtained in the previous experiments which we have just noticed (omitting a few minor modifications and irregularities observed in the complete manurial plot from unaccountable reasons which require further investigation), the results as a whole have verified previous conclusions and have, furthermore, shown that the effect of stripping canes when different manures are applied was most noticeable in those plots in which phosphoric acid was omitted or in which nitrogen was heavily present. In such cases the largest crops are found when the canes are stripped, and the least when no potash manure is present. But, on the other hand, the loss of available sugar is surprisingly great.

From another experiment it was found that the juice did not deteriorate much from the retention of the dry leaves, but that, on the contrary, the purity coefficient, sucrose, and, consequently, available sugar, were slightly increased.

Mr. Murakami remarks that it might be thought unwise and unscientific to draw general conclusions from only partial investigations carried out in Formosa, which island may differ somewhat in climatic conditions and methods of cultivation from other sugar-producing countries; yet the results thus far might be of sufficient interest and value to the sugar industry to be worth recapitulating. The conclusions drawn from the experiments are therefore given as follows:—

1. The decrease in sucrose and the lowering of the purity co-efficient and the simultaneous increase in glucose and fibre in the imported canes when stripped may be interpreted as due to a chemical activity having taken place, non-sucrose having been transformed into sucrose and sucrose into glucose.

2. This chemical activity may be influenced in the presence of a large amount of salt absorbed along with water.

3. The fresh food material thus obtained is expended in the growth of the canes, an increase in their weight and size, but, strange to say, the coloured canes for some mysterious reason are exceptions to this supposition.

4. A long exposure to the hot sun causes the rind or peel of the stalk to become much harder, especially around the joints, thus increasing the fibre content. This is not, however, the case in the Formosa varieties and the striped Singapore, all of which are rather hard in rind and thus resist the absorption of water and salt when the canes are stripped and brought to maturity.

5. The different kinds of manures do not alter these conclusions except in minor cases chiefly concerned with the nitrogen plot and the complete manure plot.

6. The juice obtained from all canes from which the dry leaves are not stripped is not inferior in its quality, but, on the contrary, has a slightly increased sucrose content and coefficient of purity.

Similar experiments in Hawaii confirm the lowering of the purity coefficient of the juice brought about by stripping, but do not wholly confirm the conclusion to be drawn from the experiments referred to above with regard to the increasing of the sugar content of the canes as the following interesting table shows:—

Number of Strippings.	Cane per Acre.	Sucrose in Cane.	Sugar per Acre.
	lb.	%	lb.
No stripping	150,950	17·14	25,873
One striping	156,467	17·00	26,599
Two strippings	142,586	17·45	24,881
Three strippings	140,031	16·24	22,741

Taking the unstripped plot as a basis, one stripping gave a gain of 3.5 per cent. on the weight of the cane and 2.8 per cent. on the weight of sugar. Two strippings gave a loss in cane of 5.6 per cent. and a loss in sugar amounting to 3.9 per cent. Three strippings decreased the cane yield by 7.2 per cent. and the sugar by 12.1 per cent. These plots were treated identically alike except with respect to stripping.

In a second series fourteen plots of four rows were taken, and the two middle rows of each plot formed the bases of the comparison. One of these was left unstripped and the other was stripped three times, namely, on the 25th January, 2nd June, and 1st November, respectively. With the exception of Plot No. 1, which was not fertilized, all the cane received the same mixed fertilizer, at the rate of 1000 lb. to the acre. This fertilizer was composed of 4 per cent. phosphoric acid, soluble in water; 12 per cent. potash, as sulphate of potash; and 9 per cent. nitrogen, as sulphate of ammonia. This fertilizer was applied as follows:—

Plot No. 1.—No fertilizer.
,, 2.—One application with seed, 1904.
,, 3.—One application in August, 1904.
,, 4.—One application in April, 1905.
,, 5.—One application in August, 1904; 300 lb. nitrate of soda, May, 1905.
,, 6.—Two applications with seed $\frac{1}{3}$, April $\frac{2}{3}$.
,, 7.—Two applications with seed: August $\frac{1}{3}$, April $\frac{2}{3}$.
,, 8.—Two applications with seed: August $\frac{1}{2}$, April $\frac{1}{2}$.
,, 9.—Two applications with seed: August $\frac{2}{3}$, April $\frac{1}{3}$.

Plot No. 10.—Two applications: August $\frac{2}{3}$, April $\frac{1}{3}$; 300 lb. nitrate of soda June.

,, 11.—Three applications: August $\frac{1}{3}$; March $\frac{1}{3}$; May $\frac{1}{3}$.

,, 12.—Three applications: August $\frac{1}{3}$; March $\frac{1}{3}$; May $\frac{1}{3}$; 300 lb. nitrate soda in July.

,, 13.—Three applications: August $\frac{1}{3}$; March $\frac{1}{3}$; May $\frac{1}{3}$; 150 lb. nitrate, September, 1904; 150 lb. nitrate, July, 1905.

,, 14.—Three applications: August $\frac{1}{3}$; March $\frac{1}{3}$; May $\frac{1}{3}$; nitrate of soda, 100 lb. per application in June, July, and August.

The following table shows the effects of stripping in such conditions upon the yields of cane and of sugar:—

Plot.	Weight of Cane-tons.		Weight of Sugar-tons.	
	Stripped.	Not Stripped.	Stripped.	Not Stripped.
1	93·31	90·52	16·05	15·39
2	64·73	88·34	10·44	14·31
3	71·09	98·01	11·15	15·39
4	91·78	108·23	14·27	17·55
5	67·00	111·25	8·72	17·38
6	82·55	112·21	12·42	17·02
7	73·57	97·88	10·23	14·38
8	72·22	99·49	10·79	14·95
9	78·10	91·30	12·29	15·23
10	76·27	101·93	11·93	15·98
11	64·29	97·36	8·91	15·47
12	84·16	111·82	13·15	17·96
13	67·08	94·09	9·32	14·61
14	84·51	108·38	11·93	17·22
Average...	76·47	100·78	11·54	15·92

The number of dead canes per acre is shown in the following table:—

Plot.	Stripped.	Not Stripped.
1	2,788	4,530
2	5,401	4,879
3	5,750	2,614
4	5,053	2,265
5	9,060	3,485
6	5,227	2,439
7	8,886	7,144
8	5,227	3,833
9	6,098	3,659
10	7,841	3,833
11	6,447	5,227
12	5,924	3,659
13	9,235	4,879
14	8,189	3,136
Average...	6,509	3,970

The broad conclusions to be drawn from all these experiments is that *one* stripping—not more—increases the weight of cane and the yield of sugar, but lowers the purity of the juice. Whether, however, these conclusions would apply to South Africa can only be definitely ascertained by local experiments. They will, nevertheless, serve as some guide to our planters.

(To be continued.)

Arsenate of Lead.

COMPOSITION OF VARIOUS BRANDS SOLD AS INSECTICIDES.

By J. MULLER, Senior Chemist, Department of the Interior, Capetown.

JUST prior to the last early spraying season samples of each of the popular brands of arsenate of lead were purchased in the open market with the object of ascertaining as to how far their composition agreed with the provisions of the Cape Fertilizers, Farm Foods, Seeds, and Pest Remedies Act, No. 20 of 1907.

Under section *twenty-six* of Amended Proclamation, No. 178 of the 5th December, 1910, it is provided that no person shall sell under the name or description of lead arsenate, plumbic arsenate, or arsenate of lead, or under any other name commonly employed to designate lead arsenate—

(1) any article containing more than 50 per cent. of water;
(2) any article containing total arsenic equivalent to less than 12½ per cent. of arsenic pentoxide;
(3) any article containing arsenic in water-soluble form equivalent to more than 0.75 per cent. of arsenic pentoxide;
(4) any article with which some other substance has been mixed or packed in such a way as to reduce or lower, or injuriously affect its quality or strength;

Provided, however, that an excess of water may be present if the resulting mixture is labelled *lead arsenate and water*, and if the actual weight of lead arsenate on a 50 per cent. water basis is plainly and correctly stated on the label.

The percentage of water present in these brands is of special importance in the fruit fly work, for which chiefly Swift's arsenate of lead has been used in preparing the poisoned sugar bait for the fly. 1 lb. of Swift's arsenate of lead is used to every 25 gallons of water; if, therefore, other brands of arsenate of lead contain a

much larger proportion of water there will be a consequent weakening of the bait if mixed according to the above formula as recommended by the Government Entomologist (Mr. Mally) in his fruit fly work.

The following eight brands of arsenate of lead were purchased and quoted as follows by the different firms:—

No.	Firm.	Address.	Description.	Price in kegs or jars.	Price per lb.
1	James Robertson & Co.	Capetown	"Swift's" ...	10 lb. jar, 7s. 6d.	9d.
2	R. M. Ross & Co. ...	"	"Bowker Insecticide"	5 lb. keg, 5s. 6d.	1s. 1½d.
3	Woodhead, Plant & Co.	"	"Eagle"	10 lb. jar, 6s. ...	7d.
4	Devine & Co.	Paarl ...	"Key"	10 lb keg, 6s....	7d.
5	White, Ryan & Co. ...	Capetown	"Sherwin, Williams & Co."	1 lb. jar, 1s. 6d.	1s. 6d.
6	Koch & Dixie... ...	"	"Mercury" ...	5 lb. keg, 4s. 3d.	10½d.
7	Jelks & Co.	"	"Electro" Dry Powder	1 lb. carton, 2s. 6d.	2s. 6d.
8	Geo. Findlay & Co. ...	"	Ferguson's "Elephant"	12½ lb. jar, 8s.6d.	8d.

These samples were analysed by Mr. W. Versfeld, analyst, in this laboratory, and yielded the following analytical results:—

No.	Description.	Water.	Total lead oxide.	Total arsenic pentoxide.	Water-soluble arsenic pentoxide.	Total water-soluble substance.	Total arsenious oxide.
		%	%	%	%	%	%
1	"Swift's"	42·2	38·13	18·61	0·50	1·45	nil
2	"Bowker Insecticide" ...	48·0	32·63	17·42	0·45	2·60	nil
3	"Eagle"	47·8	36·28	15·92	0·45	0·99	nil
4	"Key'	35·2	43·25	21·05	0·28	0·84	nil
5	"Sherwin, Williams & Co."	47·4	39·78	12·51	0·23	0·89	trace
6	"Mercury"	37·3	45·12	14·91	0·18	0·75	trace
7	"Electro" Dry Powder ...	0·14	67·12	33·49	0·43	2·03	nil
8	"Elephant"...	49·4	33·57	16·85	0·43	1·01	nil

It was evident from the results obtained that Nos. 1, 2, 4, 7, and 8 had been prepared from lead nitrate, and Nos. 5 and 6 from lead acetate. In the case of No. 3 the sample seems to have been well washed, as neither nitrates nor acetates could be detected in the sample.

Sample No. 5, "Sherwin, Williams & Co.," sold by White, Ryan & Co., contains just a trace more than the minimum of 12.5 per cent. of arsenic pentoxide allowed under section *twenty-six* of above Act.

No. 7, "Electro" dry powder, contains little more than traces of moisture, whereas No. 8, "Elephant" brand, contains 49½ per cent. as compared with 42.2 per cent. of water found in "Swift's" arsenate of lead.

In the table below is given the quantity and cost in making up the fruit fly poisoned bait according to Mally's recipe, viz.: 1 lb. of arsenate of lead (containing 18½ per cent. of total arsenic pentoxide) per 25 gallons of water:—

No.	Description.	Quantity to use to every 25 gallons of water.	Approximate cost of arsenate of lead.
1	"Swift's"	1 lb.	9d.
2	"Bowker Insecticide" ...	1 lb. 1 oz.	1s. 1¾d.
3	"Eagle"	1 lb. 2 oz.	7¾d.
4	"Key"	14 oz.	6¼d.
5	"Sherwin, Williams & Co."	1 lb. 7 oz.	2s. 1d.
6	"Mercury"	1 lb. 3 oz.	1s. 0½d.
7	"Electro" Dry Powder ...	3 oz.	5½d.
8	Ferguson's "Elephant" ...	1 lb. 1 oz.	8½d.

The Preservation and Use of Maize for Stock Feed.

By JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

(*Continued from page* 204.)

MILL AND FACTORY BY-PRODUCTS FOR FEEDING.

THE more up-to-date milling and maize manufacturing companies now make a good deal out of the sale of by-products obtained in the manufacture of mealie meal, starch, and glucose.

Some of these by-products are very rich in fats and protein, and are too concentrated to be fed alone, but may be diluted or extended with some light material like wheat bran or maize bran (*Henry*).

The products of the factory are sometimes disposed of in a wet condition, and are then called "wet starch," "wet glucose feed," etc.

Feeding tests conducted at some of the American stations have proved the high nutritive value of some of these by-products, especially "gluten meal" and "maize feed."

Maize bran.—This consists of the hulls of the maize grain, and is relatively low in feeding value, but is useful for extending concentrates such as maize meal.

Gluten feed.—This substance is obtained in the course of the manufacture of starch from the maize, and consists of all the by-products obtained in the process, which are put together and sold under this name. It is really the maize grain deprived of most of its starch. This feed is rich in fats and protein, and is considered well suited for dairy cows and for fattening stock.

The Vermont Station (Bull. 48) tested the value of "maize feed" as compared with maize meal and bran, equal parts by weight, for feeding dairy cows; the roughage consisted of two parts of hay and one of silage. There was a gain of 10 per cent. milk and 11.8 per cent. fat with the use of gluten meal (*Henry*). The composition of "maize feed" is not stated, but presumably it is practically the same as "gluten feed."

Gluten meal.—This differs from gluten feed in that it does not, as usually manufactured in the States, contain either the hull of the grain or the germ. It is a highly concentrated foodstuff, rich in protein and fats.

The Vermont Station (Bull. 48) tested the value of gluten meal, as compared with maize meal and bran, for dairy cows. These were fed daily 8 lb. maize meal and bran, equal parts by weight, during the first and third periods. In the second period gluten meal was substituted for half the maize and bran mixture. Because of the heavy character of the gluten meal it was deemed advisable that not over one-half of the concentrates in the ration consist of this material. The roughage was of equal parts, by weight, silage and hay. There was a gain of 10.4 per cent. of milk and 13.2 per cent. of fat by substituting gluten meal for half the maize meal and bran. (*Henry.*)

The Maine Station (Report, 1896) tested the value of gluten meal as compared with cotton-seed meal for dairy cows. Six cows, averaging 900 lb. each, were fed for two months on rations containing cotton-seed meal and gluten meal. The results showed that gluten meal is fully equal to cotton-seed meal when fed in sufficient quantity to make the amount of digestive nutrients equal in each ration. It is not equal to cotton-seed meal, pound for pound, as a source of protein, as it contains on an average about one-quarter less of that nutrient. It makes a very good quality of butter, but slightly softer than that made from cotton-seed meal, when fed at the rate of 3 lb. per day. The rations in this test consisted of:—

(1) Gluten meal, 3 lb.; maize meal, 2 lb.; bran, 2 lb.; timothy hay, 15 lb.; silage, 20 lb.

(2) Cotton-seed meal, 2 lb.; maize meal, 2½ lb.; bran 3 lb.; timothy hay, 15 lb.; silage, 20 lb.

The Cornell Station (Bull. 89) found that for feeding pigs a combination of gluten meal and maize meal was about 7 per cent. superior to wheat meal, when both were fed in connection with skim milk. (*Henry.*)

The Ohio Station (Bull. 60) found that gluten meal was of approximately equal feeding value, pound for pound, as oil meal for fattening steers, and that the one which can be bought for the least money is the one to use.

Maize germ.—The germ of the maize grain is very rich in oil and protein and is a highly concentrated food.

Maize-oil meal and cake.—These comprise the residue of the maize germ after most of the oil has been extracted. They still contain a good deal of oily matter and are rich in protein. "These by-products should never be fed in large quantity, but mixed with other grain feeds."

Distillers' grains.—Distillers' grains are a by-product in the manufacture of alcohol, spirits, and whisky. The annual output of distillers' dried grains from the United States is said to exceed 40,000 tons, which is largely exported to Germany for cattle feeding. "There are quite generally three grades made, one from the distillation of alcohol and spirits, a second from the distillation of Bourbon whisky, and a third from that of rye whisky. The first-named is the higher in feeding value, and is most apt to be of even quality, maize being the main, and, sometimes, the only grain used. The other grades vary in their composition in proportion to the relative proportion of maize, rye, and malt used in the mashes; the more the maize and the less the smaller grains, the better the grade of the product." (Vermont Sta. Report, 1903.)

The high protein content (35 per cent.) should render this food-stuff most valuable. It is also rich in fats (11.3 per cent.) and correspondingly low in carbohydrates (30.4 per cent.).

Brewers' grains are a by-product in the brewing of beer; they usually consist of a mixture of several grains, varying according to the locality where they are made; commonly maize, barley, and rye. Brewers' grains form an acceptable food for milch cows, where large percentages of protein are required. *(Hunt.)*

"*New corn product.*"—Under this name a substance is sold in the United States for stock food which is composed of the husks, leaf-blades, and stalks (freed from the pith) of the maize plant, ground into a coarse meal. Though it contains a high percentage of indigestible matter (crude fibre) the Maryland Station (Bull. 51, 1897) found it more digestible than timothy hay, in place of which it was successfully used for feeding horses. The protein content is only 6.5 per cent., which is less than that of maize bran; the ash is high (5.4 per cent.); carbohydrates moderately high (49.3 per cent.).

Cerealine feed.—This is a by-product obtained in the manufacture of "cerealine" breakfast foods. The crude fibre is low; protein, ash, and fat moderate, and the carbohydrates high; almost identical with "Hominy feed."

"*Hominy*" *feed and* "*Hominy chop*" are by-products of the manufacture of hominy and samp, and differ from crushed mealies principally in the higher proportion of embryo ("germ") and hull, and therefore also of protein, due to the removal of a large proportion of endosperm, consisting of much of the starch. The American analyses are almost identical with those of cerealine feed; which see.

MAIZE FOR DAIRY COWS.

Henry points out that the pre-eminence of the great dairy region of the "western" States is "due in no small measure" to the use of maize products for feeding dairy cows. "No article is more palatable to the cow than maize in almost any form, and her fondness for it has often led to its abuse. Milk production calls for a large amount of protein in the ration, . . . and as maize grain is a food

rich in carbohydrates (starch, etc.) and correspondingly low in percentage of protein, it should not form more than one-half or three-fifths of the concentrates fed to the dairy cow. It is better to feed the grain mixed with roughage."

The dairy cow when yielding a liberal supply of milk "should be regarded as an animal at hard labour. . . . The work-horse must have more grain and less roughage as his labour increases, and the same is true with the cow. A portion of the provender must therefore take the form of grain or concentrates. Moreover, if she is yielding a large amount of milk, i.e. working hard, it is best to aid her by reducing the grain to fineness by grinding. The dry cow is doing little work and can subsist on less feed, and this may be coarser in character."

"The relation of concentrates to roughage should always be borne in mind. The rule should be to feed nearly as much roughage as the cow will consume without overtaxing her; then supply sufficient concentrates to bring the digestible matter up to the required standard. About 4/10ths of the digestible nutrient should be given in the form of concentrates and 6/10ths in the roughage. It will not do to feed all grain in expectation of better returns. A satisfactory ration must possess a certain bulk or volume in order to properly distend the abdomen. Without this the process of digestion cannot proceed normally. This should never be forgotten, even when forcing cows in dairy contests." (*Henry.*)

"Gluten meal, cream gluten, grani-gluten, corn germ, and other by-products of maize are all excellent articles for feeding the cow, and their use is strongly recommended. Eastern dairymen have learned to appreciate these articles and use them extensively, while western dairymen, often living at no great distance from the factories where they are produced, know little or nothing concerning them."

MAIZE RATIONS FOR DAIRY COWS.

The Wisconsin Station obtained a number of reports from particularly successful dairymen in all parts of the United States of the rations used by them. From these I have selected the following, all of which contain maize or maize products:—

Connecticut.—Maize silage, 35 lb.; maize and cob meal, 3 lb.; hay, 10 lb.; bran, 3 lb.; cotton-seed meal, 2 lb.; Chicago gluten meal, 2 lb.

Illinois.—Maize grain, 8 lb.; oats, 1½ lb.; clover hay, 10 lb.; timothy hay, 10 lb.

Indiana.—Maize silage, 30 lb.; maize fodder, 3 lb.; clover hay, 5 lb.; oat-straw, 1 lb.; wheat-straw, 1 lb.; bran, 5 lb.; oil meal,* 2 lb.; cotton-seed meal, 2 lb.

Iowa.—Maize silage, 50 lb.; maize fodder, 5 lb.; maize ears, 5 lb.; oat-straw, 1 lb.; barley straw, 1 lb.; hay, 5 lb.; ground oats and barley, 2½ lb.

Kentucky.—Maize silage, 32½ lb.; maize fodder, 3 lb.; maize meal, 5 lb.; clover hay, 6 lb.; ship-stuff, 4 lb.; oil meal, 2 lb.

Massachusetts.—Maize silage, 40 lb.; gluten meal, 2 lb.; clover hay, 5 lb.; English hay, 5 lb.; bran, 2 lb.; cotton-seed meal, 1 lb.; oil meal, 1 lb.

* Oil meal: the residue after expressing the oil from linseed or cotton seed.

Michigan.—Maize silage, 27½ lb.; clover hay, 3½ lb.; timothy hay, 3½ lb.; bran, 3.6 lb.; oats, ½ lb.; oil meal, ½ lb.; rye, 1 lb.

Minnesota.—Maize stover, 8 lb.; maize meal, 3 lb.; clover and timothy hay, 7 lb.; oat forage (dry), 5 lb.; oats, 3 lb.; ruta-bagas, 3 lb.; bran, 2 lb.; oil meal, 2 lb.

Nebraska.—Maize stover, 5.7 lb.; maize meal, 2.9 lb.; prairie hay, 20 lb.; bran, 2.9 lb.; oil meal, 1.4 lb.

New Hampshire.—Maize stover, 10 lb.; maize and cob meal, 2 lb.; clover and witch grass hay, 10 lb.; barley forage, 5 lb.; shorts, 2 lb.; cotton-seed meal, 2 lb.

New Jersey.—Maize silage, 24 lb.; maize meal, 8 lb.; bran, 2 lb.; oats, 4 lb.; oil meal, 2 lb.

New York.—Maize silage, 25 lb.; maize meal, 4 lb.; mixed hay, 7 lb.; bran, 5 lb.; oil meal, ½ lb.; cotton-seed meal, ½lb.

North Carolina.—Maize silage, 30 lb.; maize fodder, 8 lb.; maize meal, 3 lb.; bran, 3 lb.; cotton-seed meal, 1 lb.

Ohio.—Maize stover, 20 lb.; maize meal, 8 lb.; maize and cob meal, 3 lb.; clover hay, 10 lb.; bran, 1 lb.; roots, 8 lb.

Pennsylvania.—Maize silage, 45 lb.; mixed hay, 7 lb.; bran, 6 lb.; cotton-seed meal, 2 lb.

Texas.—Maize silage, 30 lb.; maize meal, 1.3 lb.; sorghum hay, 13½ lb.; cotton-seed meal, 2.6 lb.; cotton seed, 2.2 lb.; wheat bran, 1.3 lb.

Vermont.—Maize silage, 35 lb.; maize meal, 3.2 lb.; mixed hay, 10 lb.; bran, 2 lb.; oil meal, 1 lb.; cotton-seed meal, .8 lb.

West Virginia.—Maize silage, 48 lb.; maize and cob meal, 2½ lb.; ground wheat, 2½ lb.; barley meal, 2½ lb.; oats, 2½ lb.

Wisconsin.—Maize silage, 40 lb.; clover hay, 8 lb.; bran, 6 lb.; pea meal, 2 lb.

Canada (Eastern).—Maize silage, 15 lb.; turnips, 45 lb.; wheat chaff, 7 lb.; oats, 2½ lb.; pea meal, 2½ lb.

Summarizing the above we find that

Maize silage is used for feeding dairy cows in the States of Connecticut, Indiana, Iowa, Kentucky, Massachusetts, Michigan, New Jersey, New York, North Carolina, Pennsylvania, Texas, Vermont, West Virginia, and Wisconsin, and in eastern Canada. The amount used ranges from 15 lb. in eastern Canada to 50 lb. in Iowa, the average being about 34 lb.

Maize stover.—Minnesota, Nebraska, New Hampshire, and Ohio. Amount used: from 5.7 lb. in Nebraska to 20 lb. in Ohio.

Maize fodder.—Indiana, Ohio, Kentucky, and North Carolina. Amount used: from 3 lb. in Indiana and Kentucky to 8 lb. in North Carolina.

Maize grain.—Illinois; amount used: 8lb.

Maize ears.—Iowa; amount used: 5 lb.

Maize meal.—Kentucky, Minnesota, Nebraska, New Jersey, New York, North Carolina, Ohio, Texas, and Vermont. Amount used ranges from 1.3 lb. in Texas to 8 lb. in New Jersey and Ohio.

Maize and cob meal.—Connecticut, New Hampshire, Ohio, and West Virginia. Amount fed: 2 to 3 lb.

*Gluten meal.**—Connecticut and Massachusetts. Amount fed: 2 lb.

* Gluten meal: prepared from maize.

MAIZE FOR FATTENING BULLOCKS.

Some idea of the extent to which maize is used for fattening cattle in the Western States may be gathered from the statements of the Standard Cattle Co., Ames, Nebraska, of which an extended account is given by Coburn (Kansas State Board of Agriculture, Quarterly Report, December, 1897). Taking one year, 1896-97, as an example, we find that 5454 head of cattle were marketed; these were fed for 215 days, the average gain per beast being 238 lb., or 1.1 lb. per day. To secure this gain the average amount of food consumed per head was

Maize grain	3900 lb.
Maize stover	2150 ,,
	6050 ,,
Hay	1483 ,,
Bran	2.3 bushels.
Oats	.2 ,,
Barley	.7 ,,
Oil cake	.7 ,,

Henry has worked out the following rations compounded in accordance with the Wolff-Lehmann feeding standard for steers weighing 1000 lb. "These rations are constructed on purely theoretical grounds, but will be found satisfactory where the feeding stuffs called for are reasonable in price."

	Amount Fed.	Dry Matter.	Protein.	Digestible Nutrients. Carbo-hydrates.	Digestible Nutrients. Ether Extract.
Ration 1:	lb.	lb.			
Maize fodder ...	8	4.62	.20	2.77	.03
Clover hay	2	1.69	.13	.72	.03
Dent maize	14	12.52	1.09	9.34	.60
Oil meal, O.P. ...	4	3.63	1.17	1.31	.28
TOTAL	28	22.46	2.59	14.14	.94
Ration 2:					
Maize silage... ...	30	6.27	.27	3.39	.21
Oat straw	5	4.54	.06	1.93	.04
Roller bran	10	8.81	1.22	3.92	.27
Corn and cob meal ...	4	3.40	.18	2.40	.12
Cotton-seed meal ...	2	1.84	.74	.38	.24
TOTAL	51	24.86	2.47	12.02	.88

The following rations, which include maize in some one form or another, have been selected from those used by the various State experiment stations:—

Stover and Maize Grain (*Kansas Station, Bull.* 39).

	lb.
Maize stover	5
Ear maize	26.7
Total	31.7
Average weight of steers fed	1211
Daily grain	1.7

Maize Meal "Balanced" (*Kansas Station, Bull.* 34).

	lb.
Maize meal	10
Shorts	5
Bran	2
Oil meal	4
Tame hay	6.5
Total	27.5
Average weight of steers fed	1083
Daily gain	2.4

Maize Silage (*Texas Station, Bull.* 27).

	lb.
Maize silage	20
Cotton-seed meal	5
Cotton-seed hulls	7.2
Total	32.2
Average weight of steers fed	638
Daily gain	1.76

Maize Silage (*Oregon Station, Bull.* 37).

	lb.
Maize silage	18
Clover hay	8
Chopped wheat	10.3
Total	36.3
Average weight of steers fed	847
Daily gain	.2

Maize Grain and Roots (*Ontario Agricultural College, Rep.* 1883).

	lb.
Maize grain	9.25
Roots	34
Hay	9.5
Bran	3.5
Total	56.25

Average weight of steers fed...	1106
Daily gain...	2.31

Maize Grain and Meal, plus Oil Meal (Iowa Station, Bull. 20).

	lb.
Snapped maize	22.5
Maize meal	3.7
Oil meal	4.2
Hay...	5.7
Average weight of steers fed	1340
Daily gain	2.8

Maize Grain and Cotton Seed (Texas Station, Bull. 27).

	lb.
Maize grain	5.3
Cotton seed	5.2
Hay...	5.3
Total	15.8
Average weight of steers fed...	576
Daily gain...	1.9

(To be continued.)

Tuberculosis at Potchefstroom.

THE RECENT OUTBREAK AT THE EXPERIMENTAL FARM.

THE following particulars, supplied by Mr. Alex. Holm, Under-Secretary for Agriculture, and late General Manager of the Potchefstroom Experimental Farm, of the recent outbreak of tuberculosis amongst cattle on the Experimental Farm, Potchefstroom, are published for general information.

With the exception of the trek oxen and small herds of cross-bred and pure-bred Afrikander cattle the whole of the cattle on the farm are pure-bred, and consist of imported stock or their descendants. The first importation of pedigree cattle, which was from Great Britain, took place in August, 1903. Subsequently a few animals were imported each year, and in October, 1908, a number of Fries cattle were imported. In all cases the cattle imported possessed the usual documents certifying that they had been submitted to the tuberculin test in the country of origin and had not reacted. Further, all animals imported were, in recent years, subjected to a second test on arrival in this country. In the spring of 1905, and in each succeeding year in September and October, all the adult breeding cattle for the farm were tested, i.e. animals over two and two and a half years of age; while in 1912, in view of the reactions which then took place, all animals over six months were subjected to the test. The Veterinary

Division carried out the test, and reacting animals were dealt with according to its directions. The results of each year are as follows:—

	Number of Animals Tested.	Number of Reactors.	Percentage of Reactors.
1905	119	8	6·7
1906	124	12	9
1907	120	None	—
1908	118	5	4·2
1909	131	None	—
1910	148	None	—
*1911	169	2	1·2

* Exclusive of one bull, tested soon after importation. This animal reacted, was isolated, and subsequently destroyed.

During this period the reactors were immediately isolated and subjected to a retest, and those which failed to react were passed back to the herd; the others were slaughtered. During the period 1911-1912 only two or three animals which had given one reaction in previous years were to be found in the herd.

No reactors were found in 1909 and 1910, and in 1911 only two animals reacted, which were immediately isolated and subsequently slaughtered. At this time it was considered that the disease had been stamped out.

The result of the tests in 1912, which are given hereunder, were quite unexpected. They are as follows:—

FRIES.

	Imported.		Bred on Farm.	
	Number Tested.	Reactors.	Number Tested.	Reactors.
Bulls ...	1	1	8	3
Cows ...	11	5	4	3
Heifers ...	—	—	6	2
Calves ...	—	—	6	1

Total tested, 36; Reactors, 15; Percentage of Reactors, 41·6.

AYRSHIRES.

	Imported.		Bred on Farm.	
	Number Tested.	Reactors.	Number Tested.	Reactors.
Bulls ...	1	1	9	2
Cows ...	9	7	19	4
Heifers ...	—	—	19	—
Calves ...	—	—	7	—

Total tested, 64; Reactors, 14; Percentage of Reactors, 20·3.

RED LINCOLN SHORTHORN.

	Imported.		Bred on Farm.	
	Number Tested.	Reactors.	Number Tested.	Reactors.
Bulls ...	1	1	5	—
Cows ...	5	2	10	4
Heifers ...		—	20	—
Calves ...	—	—	1	—

Total tested, 42; Reactors, 7; Percentage of Reactors, 16·6.

HEREFORDS.

	Imported.		Bred on Farm.	
	Number Tested.	Reactors.	Number Tested.	Reactors.
Bulls ...	1	—	3	1
Cows ...	3	—	8	—
Heifers ...	—	—	10	—

Total tested, 25; Reactors, 1; Percentage of Reactors, 4.

SUSSEX.

	Imported.		Bred on Farm.	
	Number Tested.	Reactors.	Number Tested.	Reactors.
Bulls ...	1	—	11	—
Cows ...	26	2	14	2
Heifers ...	-	—	23	—
Calves ...	—	—	1	—

Total tested, 76; Reactors, 4; Percentage of Reactors, 5·27.

1	"Coates" Shorthorn Cow	No reaction.
27	Pure-bred Afrikander Cattle	No reactions.
42	Cross-bred Afrikander Cattle	No reactions.
70	Oxen	Two reactors.

Total number tested	385
Total number reactors	43
Percentage of whole herd reacted	11·2

17 of the 43 reactors have been slaughtered. 26 still remain, 21 cows and 5 bulls; these are at present, and were since they reacted to the test, completely segregated.

REACTORS SLAUGHTERED IN 1912.

LESIONS (WHERE FOUND).

	Breed.		*No.*	*Lesions.*
1	Ayrshire Bull	...	46	Bronchial and popliteal lymphatic glands.
2	„ „	...	36	Lungs.
3	„ Cow	...	34	Lungs and liver.
4	„ „	...	33	Lungs and liver, and bronchial lymphatics.
5	Fries Bull	...	23 P.	Pharyngeal and mesenteric lymphatic glands and lungs.
6	„ Cow	...	24 P.	Bronchial and lymphatic glands.
7	„ „	...	8 P.	Bronchial and cardiac glands.
8	„ Bull Calf	...	31 P.	No visible lesion of tuberculosis, but intestines showed appearance of Johne's disease.
9	Lincoln Red Cow	...	28 P.	Bronchial lymphatic glands.
10	Hereford Bull	...	31 P.	Liver and mesenteric lymphatic glands.
11	Sussex Cow ...	...	28 P.	Bronchial glands.
12	„ Calf from	...	28 P.	Also killed, no lesion seen.
13	Sussex Cow ...	...	40 P.	Mesenteric glands and lungs.
14	40 P. Calf ...	...	—	No lesions seen.
15	„ 4 P. ...	...	—	„ „
16	„ 5 P. ...	...	—	„ „
17	„ 113 P. ...	...	—	Mesenteric lymphatic glands.
18	Afrikander Ox	...	17 P.	Bronchial lymphatic glands and abscesses lungs and liver.
19	Cross-bred Ox	...	8 P.	Bronchial glands.

In eight animals the tuberculous lesions were confined to the respiratory tract and bronchial lymphatics.

In two cases the lesions were present only in the mesenteric lymphatic glands.

In five animals the lesions were present both in the alimentary and respiratory tracts.

From the above it may be concluded that the infection was mainly through the respiratory tract, but that it also occurred by ingestion there can be no doubt; two animals showing lesions confined to the mesenteric glands only. Those animals which showed lesions in the alimentary and respiratory tract may be cases of auto-infection, but in all cases the lesions were small in extent, and all the animals were in good condition and showed no clinical symptoms of the disease.

In connection with these records the dairy breeds in the Fries and Ayrshire cattle and most of the Red Lincolns were grazed on the same pastures and were housed in the same buildings, while the Herefords, Sussex, and Afrikanders were for the most part grazed and housed apart from the other breeds.

Prior to 1912 the reactors, with one exception, were confined to imported animals, but in the above returns it will be observed that a number of animals bred on the farm reacted in 1912.

In considering this outbreak the system of management should be described in general terms. The dairy breeds are grazed on the veld during the night as well as during the day between the months of October and May inclusive, and except on a few very stormy nights are only under shelter about three hours daily during milking times. During the winter season, June to September inclusive, they roam in the open air for a few hours during the day and are accommodated in a large well-ventilated cow byre constructed of brick with granolithic floors and mangers. The walls thereof are frequently whitewashed with lime, the fittings are tarred, and the floors are regularly cleansed.

The animals of the other breeds either run on the veld entirely night and day, or are housed during the winter months only in open sheds and yards.

It may be observed that out of seven bulls retained for "stud" purposes, five reacted. These bulls were housed in separate loose boxes, with 6-feet walls between and separate open yards for exercise, while the building itself is so constructed as to permit the freest circulation of air possible. In other respects it is similar in construction to and cared for in the same way as the cow byre.

It is significant that in so short a period of time, viz., within twelve months, so many animals reared and maintained under these conditions should have reacted. It illustrates how rapidly and how easily infection may take place, even in the sunny climate of South Africa. Clinical symptoms of the disease have been absent in the herd; no animal has died of the disease (with possibly one doubtful exception in 1906), and the reacting animals were all in excellent condition.

The disease was probably spread by one or more animals in which there were open lesions, which failed to act to the tuberculin test. At all events the results of the tests are interpreted in this light, and the assumption is reasonable.

It will thus be seen that a systematic effort has been made all along to stamp out the disease, and unfortunate though the results have in some respects been there is hope that with the increasing knowledge which is being acquired with regard to the disease and the tuberculin test itself, it will eventually be overcome.

It may be added that there is no foundation for the statements that certain bulls sent from Potchefstroom Farm to other Government farms have recently been found to be tuberculous. All bulls offered for sale from the farm have been tested before sale.

Conference of Tobacco and Cotton Division.

A ROUND-TABLE conference was held in Pretoria towards the end of March of officers of the Tobacco and Cotton Division of the Department of Agriculture, when the following papers were read and discussed. It is proposed to publish these articles consecutively in the *Agricultural Journal*, commencing probably with the next issue:—

1. The Production of Bright Tobacco. By H. W. Taylor.
2. The Production of Turkish Cigarette Tobacco. By L. M. Stella.
3. Warehouse Management. By T. E. Elgin.
4. The Production of Cigar Wrapper Tobacco. By W. B. Wilson.
5. Developing a New Station.
6. Cotton Culture in South Africa: Best Varieties for this Country. By A. van Ryneveld.
7. Crop Rotation with Tobacco and Cotton in the Rotation, and the Use of Fertilizers. By E. H. T. Powell.
8. Cotton Lint, to the Manufactured Articles. By R. T. Falgate.

The proceedings were opened by Mr. W. H. Scherffius, the Chief of the Division, who delivered the following address:—

GENTLEMEN,—I have called you together to hold the first round-table conference of the Tobacco and Cotton Division. It has been my intention for the past four years to organize an annual conference of the officers of this Division; but on account of a much-needed reorganization and a certain lack of systematic endeavours, not only my time but all of yours has been needed to get our work well organized. While I am aware that there is still much to be done in this respect I think we all realize that our efforts are taking shape along sound and useful lines. Let us trust that this is the beginning of a series of successful meetings that we may have.

We all have our special fields of endeavour; but there are many problems of general interest to the public which confront us daily, and it is our duty as public servants to keep posted along broader lines than those designated by the position which we hold. In my opinion just such conferences as this which we are about to hold will go a long way towards broadening our views and making each of us a specialist or an expert in the liberal sense.

Take the case, for example, of the officer in charge of the Piet Retief Station. He is not only the officer in charge of the Tobacco and Cotton Experiment Station, but is expected to be the agricultural adviser on practically all farm crops grown in the Piet Retief District. In order for him to give up-to-date, thoroughly sound, and practical advice he should be the best posted man, both in theory and practice, in the district.

The aim of this conference is to better prepare us to intelligently cope with the numerous and difficult problems with which we have to encounter daily. I feel confident that if we earnestly digest the deliberations of these conferences we will be better qualified, as Government officials, to serve the public.

The branch of the Civil Service which we represent might be termed the Information Bureau of two Industries, which, I am happy to state, are making progress in this country. One day you and I will reflect with pride that, under our guidance, two enormous industries have been built up here in South Africa—industries which will produce from the soil undreamed of millions of wealth and build thousands of happy comfortable homes over our vast stretches of idle veld. Scientifically applied, we have been doing mostly pioneer work up to the present, building the foundation for scientific investigation towards the improvement of the tobacco and cotton crops in South Africa. Think for a moment of some of the important problems confronting us that remain unsolved.

Turkish Tobacco Seed.—We have not yet been able to produce in this country Turkish tobacco seed which retain in their matured plant the aromatic flavour and other superior qualities obtained from the parent plant grown from imported seed. We are sure that this can be done and we will do it, once we are given a properly equipped station to conduct experiments leading to that end. At present we are at the mercy of a foreign country having a prohibitive law against the exportation of tobacco seed. Smuggling cannot be practised indefinitely without the offenders falling into the clutches of the law.

Flue-curing.—The art of flue-curing tobacco in this country is still in its infancy, and although we have made great progress there is still much to be found out before we can say we have perfect control over the results.

Think what it would mean to this country if we could produce 75 per cent. to 80 per cent. of yellow leaf instead of about 40 per cent., even in the most likely districts. Recently a representative of a big cigarette manufacturing firm from Australia was here and stated that his firm would be prepared to take more than a million pounds of leaf annually if we could furnish the article he required.

Flue-curing or Air-curing.—Taking into consideration the cost of construction and cost of operating the sheds, the question of the best method of curing tobacco, whether by flues or by air, is still a doubtful one, nor have we determined the style of barn better adapted to these methods.

Cigar Wrapper Leaf.—The production on a commercial scale of real "cigar wrapper leaf" in this country is scarcely known at present. While some of the leaf produced at our stations is of a superior quality, much remains to be done in selection and breeding of strains having leaf with fine veination and good shape, possessing good burning quality, aroma, and colour. The quantity and quality of tobacco produced per acre can also be considerably increased by selecting for seed plants carrying the greatest number of leaves.

Certain Types for Certain Districts.—At present we have but little data as to which type of tobacco is best suited in certain districts. We hope to be able, as time goes on, to draw lines around fairly well defined areas and then say to the public this type will give the most profitable results in that area—the same as is done at present in some of the big tobacco-producing countries.

Fertilizers and Crop Rotation.—The question of the best fertilizers and best methods of crop rotation in order to obtain the maximum yield of crops, and at the same time do a minimum amount of harm to the soil, is receiving our attention at present. We are obtaining very valuable data on this subject, but right here we have a field of investigation which will occupy our attention for years to come.

Diseases and Insects.—Diseases and insects, although pathological and entomological in their nature, are so associated with our work that they are daily calling for attention. Take, for example, the disease known as "mosaic" or "frenching," and the insect trouble known as "eelworm" or "nematode." If we could find a remedy for these troubles we would do a distinct service to the agricultural world which could not be measured in monetary consideration.

Cotton.—With the cultivation of cotton we have many similar problems, such as finding out in which districts certain varieties are best suited, and in which districts cotton could be made a paying crop; how to best combat insect pests; how, by selection and breeding, to improve the quality and quantity of cotton produced; how to create a local market for cotton; how to utilize the by-products, etc.

With these remarks I will conclude by hoping that your short stay in Pretoria may be both pleasant and profitable.

Poultry in Hot, Damp Weather.

By A. LAURENCE, Poultry Instructor, Cedara.

Now that the wet season is upon us, it behoves farmers to be on the watch for the first sign of sickness amongst their fowls. The continuous hot, damp weather that is so prevalent at this time of the year is very favourable to outbreaks of those much-dreaded diseases, chicken-pox and roup.

Care and attention do much to minimize these evils. Shelter is of great importance, as no doubt all animals and birds find having to stand about in the hot sun very trying indeed.

It is one of the drawbacks to hatching late in the season that the chicks do not seem to have developed sufficient stamina to withstand this trying weather.

Chicken-pox is first noticed by small sores appearing upon the heads of the chickens; if not attended to at once these sores grow and spread all over the comb, head, and face, and when broken they exude an almost colourless matter. This disease is highly infectious, therefore the sick birds should at once be isolated and the sores dressed with permanganate of potash. The best method of applying this is to put a small quantity of the crystals into a piece of cloth, tie this firmly on to the end of a small stick, moisten slightly with a little water, and touch the sores with this. The ailing chicks and any contact birds should be given a little flowers of sulphur in soft food and be liberally fed with greenstuff.

Roup.—There are two kinds of roup. The most common is *catarrhal.* This is extremely contagious and is commonly caused by the birds being overcrowded into ill-ventilated houses. The first symptom is a watery discharge from the nostrils, which gradually becomes thicker and developes an offensive odour. Sometimes one side of the face becomes badly swollen and a frothy moisture appears at the eye; at a later stage the eye completely closes and a solid cheesy matter forms, which must be squeezed and washed out.

Diphtheretic Roup.—In young chicks this is often mistaken for *gapes*, as the outward symptoms are perhaps to the novice somewhat similar. In both cases the bird gapes or gasps as if for breath. The cause of this in diphtheretic roup is a growth of cheesy matter which accumulates in the throat and windpipe, and unless attended to immediately causes suffocation.

Treatment.—The cheesy matter should be cut out with a knife or piece of stick, a little flowers of sulphur put in a teaspoon and blown sharply down the bird's throat.

In both catarrhal and diphtheretic roup all contact birds and sick ones should be given sulphate of copper (bluestone) to drink. Dissolve ½ oz. of sulphate of copper in 8 oz. of water and add a teaspoonful of this to every half-pint of drinking water. Care should be taken that the drinking vessels are earthenware or of good enamelled ware, as the sulphate of copper corrodes iron and tin.

Moulting.—This is the best time of year to weed out any surplus stock that is to be disposed of. The hens will have practically stopped

laying previous to going into the moult, and it is more economical to sell now while the birds are in good condition than to bring them through the moult, which naturally reduces their condition, and then to feed them up again and sell them.

To hasten on the moult, birds should be fed very sparingly, that is to say on a little grain only, kept warm, and should be given a few doses of epsom salts. When the birds are fairly into the moult, which will be seen by the number of feathers lying about the runs, the feeding should become more liberal and a dose of flowers of sulphur given twice a week in their soft food—a teaspoonful to every twelve birds.

Essays on Irrigation.

ANNOUNCEMENT BY IRRIGATION ASSOCIATION.

THE South African Irrigation Association, being desirous of spreading information of a reliable character on the subject of irrigation farming in the Union of South Africa, asks for contributions on any and every phase of this important subject. The Department of Agriculture having kindly agreed to find space for the publication of such articles as may be approved in the *Agricultural Journal*, they will appear from time to time in these pages, together with such other matter as may be deemed of importance dealing with irrigation subjects.

In order to encourage all who may have the requisite information the South African Irrigation Association is prepared to pay for these contributions on a graduated scale from two to five guineas per accepted article, according to merit. The selection of these contributions and the editing of this matter is in the hands of the Secretary of the Association (Mr. F. D. MacDermott), with whom is associated in this work the Director of Irrigation (Mr. F. E. Kanthack). All contributions that may be accepted and paid for will become the property of the South African Irrigation Association. Unacceptable MSS. cannot be returned unless accompanied by stamped addressed cover for that purpose.

It should be distinctly understood that this is in no sense a competition like that recently conducted by the Irrigation Association. It is an earnest endeavour to gather reliable information on irrigation farming in South Africa from every conceivable standpoint for the enlightenment of agriculturists of the whole country. It is suggested that the best of these contributions be published in the "Irrigation Year-book," which the Association proposes to issue in the future, so that there is every encouragement to contributors to offer their best.

Contributors may choose their own subjects, provided, of course, that it is of sufficient general interest to warrant publication. Two stipulations have to be made, however. The first is that no contribution shall exceed 5000 words (approximately); the second is that all manuscripts must be written or typed on one side of the paper only. Contributions will be accepted in either of the official languages.

In all cases conciseness and lucidity will be expected. What is wanted is first-hand knowledge gained by personal experience of the many problems which face the irrigator in the varying conditions of this country. Such matter will always be given first consideration. Quotations from textbooks and references to what may be doing in other countries will also find a place, but what is most needed at the present juncture is some system of placing on record the vast wealth of practical experience which has been gained at much cost by the irrigators of the Union.

Diagrams and photographs may be included where they may be considered necessary, and if suitable and considered of sufficient importance, they will be published with the contribution they accompany.

All contributions intended for these pages should be addressed in the first place to

F. D. MacDermott,
Secretary, South African Irrigation Association,
P.O. Weenen, Natal.

[Note.—As a beginning we publish in this issue the First Prize Essay on "The Distribution of Water." This essay, the work of Mr. F. le Roux, of Liberty Hall, Volksrust, Transvaal, who wrote under the name of "Aquator," was awarded the prize of £15 offered by the Association last year. There were no less than forty-three competitors, and many of the other essays were quite meritorious. As occasion offers we propose publishing some of them, according as space permits.—Editor, *Agricultural Journal.*]

The Distribution of Water.

By "AQUATOR" (F. LE ROUX, Volksrust).*

IRRIGATION is the distribution of water by artificial means over an area of cultivated land for the profitable production of crops in regions where the rainfall during a definite season is insufficient to mature such crops.

In irrigation due consideration should also be given to land drainage, or the withdrawal of such part of the water as does not evaporate, the one method being virtually the opposite to the other.

This article is, however, confined solely to the distribution of water, or irrigation, as practised and required in South Africa; and due regard will be given to three main considerations, viz.:—

(*a*) The character of the water supply.
(*b*) The character of the soil to be irrigated.
(*c*) The surface conditions and slope of the land.

Since the falling of rain upon soils in any region has always been intermittent in character, since during the intervals of fair weather a part of the water so given to the soil is lost by evaporation or drainage, and since vegetation will thrive best only when a certain definite amount of moisture is given and retained in the soil, for use by such vegetation, it follows that proper distribution of water over given periods by artificial means becomes necessary for the most profitable means of carrying crops to maturity. This being true, there would occur times with almost all soils when they would give larger yields if they could be artificially irrigated than they would have done if the irregularity of the rainfall, the high velocity of the wind, and the rapid evaporation in a hot climate had to be contended against.

But not all soils are alike in their capacity for retaining moisture and of permitting it to draw away, and this being so under one and the same condition of rainfall one field might benefit by irrigation while another one would profit by better drainage. Taking this into consideration it would be wise, where the quantity of water for disposal is limited, to take due precaution in selecting the soil to be irrigated and by frequent and deep tillage always to conserve as much water as possible in the soil itself, for the production of crops without any undue drain on the supply for disposal.

When the supply of water is limited, a soil that has a greater capacity for retaining moisture is far more suitable for the purpose of irrigation than an arid soil that would require frequent application of water in order to retain a uniform amount of moisture to bring a crop to maturity. And even where the water supply is abundant such a soil is still more profitable to cultivate than a soil that requires frequent application of water to keep uniformly damp, as it minimizes labour in irrigating and saves water for other purposes.

Loose, porous soils that require frequent application of water could, however, be more profitably used for root crops, and perhaps

* First prize essay in 1912 competition of the South African Irrigation Association.

barley, than damp soils where drainage is imperative at certain times. The frequent application of water to root crops (and barley) on subsoil that would drain away any superfluous water instantaneously, is far more likely to give a maximum return than where the soil is less porous and retains the water for longer periods.

It may be laid down, as a general rule, that the water of highest value for the purposes of irrigation is the sewage of large cities, unless it contains too large amounts of poisonous products from factories in the form of injurious chemical compounds.

The organic matter in such sewage is of the highest value as a fertilizer for many crops, and in all warm climates it is often practicable and very desirable to use such water for irrigation.

Next in value to sewage water must be placed that of streams carrying considerable quantities of suspended solids. It is generally recognized that the richest and most enduring soils of the world are those formed from the alluvium of streams, laid down by the water on its flood plains; and when this is true, it will not be strange that turbid water has generally been held in great esteem for irrigation on account of its fertilizing value. When such sediments are laid down upon sandy soils it will be readily appreciated that the gain to the field is far greater than that due to the mere plant food which the sediments contain.

It is affirmed that in Egypt, under the old system of the Pharoahs, basin irrigation which permitted the rich mud to collect in the fields kept them fertile for thousands of years, and they are so to-day; whereas in lower Egypt where the old practice has been abandoned in recent years for an "improved" system, which does not permit the utilization of the rich Nile mud, the fields are fast deteriorating in fertility, although only half a century has passed.

The above will prove how highly necessary it is in laying out a system of irrigation to take every precaution and to utilize every available chance to get the best results, and eventually the highest returns by judicious use of what available quantity of water can be stored, and by always aiming, where it is possible, to obtain such water that could do the highest duty to the soil, both in plant production and improving the soil itself.

The most important consideration after the nature of the water supply, and the very nature of the water itself, is the nature and character of the soil to be irrigated.

Not all soils are alike in their capacity for retaining moisture and of permitting it to drain away, and this being true under one and the same conditions, one field might be benefited by a certain way of irrigation, while another would, under similar circumstances, profit by better drainage.

It is this fact of varying capacity of soils to store water for given periods of time that, in the struggle for existence and of filling and refilling among plants, has led to the evolution of species which can thrive best in soils of certain texture. This is a fact of fundamental importance and consequence, and it is the duty of every irrigator to discriminate between one crop and another, as well as the exact amount of water required by such soil, in order to obtain the best results under all circumstances.

Reasoning from general principles, one is naturally led to anticipate that in an exceptionally dry atmosphere and under a clear sky the rate of evaporation, both from soil and vegetation, would be

exceptionally rapid, and hence that enormous quantities of water would be required for crop production when compared with the demands of crops under more humid conditions. Experience, however, has taught that, especially in the eastern Transvaal, and more particularly in the so-called high veld, the high velocity of westerly winds is much more responsible for loss of moisture in soil or vegetation.

When water is plentiful and is being used freely, and especially where irrigation by flooding is being practised, the soils having the coarsest, most open, texture will waste the most water by percolating through the zone of root feeding. Hence on this account the duty of water would be smaller on these soils than on those having finer texture. But, on the other hand, the surface evaporation from the coarser soils is so much greater than from the sandy soils that the quantity of water is much more nearly equal on them than it could be were it not for those opposite characteristics.

The character of the sub-soils, as well as that of the surface soil, is an important factor in determining the quantity of water, especially in the hands of the unskilled irrigator, and particularly so if he possesses no knowledge or exercises poor judgment regarding the water-holding power of the soil to which the water is being applied.

Where the texture of the sub-soil is coarse, and its water-holding powers small, it requires the best of judgment, both in regard to the amount of water which may be applied at one time and as to the rate it should be led over the surface or along the furrows, in order that there shall be no waste by percolation below the depth of root feeding.

After the above general principles it becomes necessary to inquire into the more practical part of irrigation or the distribution of water, with proper regard to the nature of the water supply, and the character of the soil to be irrigated, but no less to the surface conditions and slope of the land.

When water has been provided for irrigation and brought to the field where it is to be applied, the steps which still remain to be taken are far the most important of any in the whole enterprise, not excepting those of engineering, however great, which may have been necessary in providing a water supply which shall be constant, ample, and moderate in cost; for failure in the application of water to the crop means utter ruin for all that has gone before.

To handle water on a given field so that it shall be applied at the right time, in the right amount without unnecessarily washing the soil or injuring the crop, requires an intimate acquaintance with the conditions, good judgment, close observation, skilful manipulation, and patience, after the field has been put into excellent shape; and right here is where a thorough understanding of the principles governing the wetting and washing of soils and possible injury to crops as a result of irrigation becomes a matter of greatest moment. There is great need of more exact scientific knowledge than we now have to guide the irrigator in his handling of water.

One of the commonest mistakes of beginners in irrigation is the use of too large volumes of water in one place and hurrying it over the ground too rapidly. It must be kept ever in mind in all sorts of irrigation that the eroding and transporting power of water increases with the velocity with which it moves, but in a higher ratio; to double the rate at which water moves in a furrow, or over the surface, increases its power to wash and carry the soil forward nearly fourfold.

In good irrigation the water is forced to move so gently that it runs nearly or quite clear and without washing the sides or bottom of the furrows, and if one does not succeed in securing flows without washing the only conclusion which should be drawn is that the right way has not yet been learned, not that it cannot be done.

Naturally the steeper the slope of the furrows the faster the water tends to run; so, too, when the slope remains the same, the larger the volume of water in the furrow the faster the water will flow, and these two principles give the irrigator nearly complete control of the situation.

If the ground is flat and the water moves too slowly increase the amount in the furrow, and if there is not water enough to do this decrease the number of furrows handled at a time. If the water runs too fast and washes divide the stream into more furrows until the movement comes to be the rate which does not wash or erode.

The most essential point in the distribution of water is to have the furrows on a nearly uniform slope so that the velocity of flow will be nearly uniform through their entire length. If the same grade cannot be secured throughout it is better to change from a steeper slope to one more flat than the reverse, because then the reduction in velocity will be partly made up by a greater depth of water in the furrow on the flatter reaches.

When large areas of land are to be irrigated in single blocks there is no method of applying water which is so economical of labour and of time as the system of flooding, wherever it is possible to establish and maintain the best conditions for it, and there is no other system which permits of so uniform a wetting of the surface.

There are two fundamentally different systems of flooding. One covers the surface of the field with a thin sheet of running water, maintained until the desired saturation has been reached, the other covers the surface with a sheet of standing water which is allowed to remain until the soil has absorbed enough when the balance is drawn off, or simply as much water as is desired is placed upon the land, and this remains upon the surface until it is absorbed.

These two systems are used mostly for crops like small grains which closely cover the ground and where inter-tillage is not practised.

Personal experience has taught the following system in flooding where the natural slope of the ground is good. A distributing ditch or main furrow is carried along the highest edge of the field to be irrigated.

When ploughing is commenced the entire field is divided into lands 12 yards wide, so that after the ploughing and harrowing is completed the land forms parallel ridges at a distance of 12 yards apart; and along these parallel ridges furrows are made by using a V-shaped plough with a double concave moldboard throwing the earth both ways, and thus forming distributing furrows. The ridge of earth on either side of the furrows serves the purpose of borders to the land, which prevent the return of the water to the furrows after it has been thrown out by a dam. Where the stream is not very strong, an ordinary grain bag, with or without a little ground in it, forms a very effective dam and prevents washing.

If, however, the slopes of the field are steep, and especially if they incline in various directions, an entirely different system of irrigation should be followed and flooding is practically impossible. In this case water-furrows are made across the surface of the slope nearly

along contour lines and fairly close together, allowing as little fall as possible, and only so much as is needed to carry the water forward. An ordinary plough would be preferable to a ridge plough, and the furrows should then be drawn with the ridge towards the lower slope. In watering by this method the aim is to throw the water over the lower edge of the furrow in a continual sheet, or else at short intervals, to flow down the slope until the portion of the field within reach has received what is needed.

Here again personal experience has proved that in many instances it is better to allow the water to run along these contour furrows until the entire stretch between any two furrows is saturated. This process requires no continual stopping of the current, which on very slopy lands is no easy task.

In orchard irrigation, several methods of distributing water are practised, but there is none followed so generally and with such good result as the furrow method, where the water is allowed to flow slowly in small streams through the furrows for a long time, somewhat after the method above described in slopy lands, until the water has penetrated by percolation beneath the surface, and at the same time has spread broadly by capillarity sideways under the surface mulch to the roots of the trees.

No matter from what standpoint the entire subject is regarded, one fact stands out pre-eminently above all others, and that is the infinite advantage of irrigation over all other methods of agriculture. The very fact of the extent and geographic range of irrigation all over the world (whether the system be as large as in the Indus basin and along the Nile regions where mighty rivers have been diverted from their course in ancient times, or whether a system is kept up by windmills, Noria pumps, or even sacks drawn by a mule, as quite recently practised in some parts of South Africa) indicates that it has become an innate desire in mankind to assist nature by storing waste water in normal times for utilization in the production of the necessaries of life during abnormal droughts; and the sooner every agriculturist in our happy Union appreciates this fact, and helps to conserve the millions of gallons of water running to waste annually, the sooner may we hope to become a self-supporting community.

[Plate No XLIV. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Oldenburg Stallion, "Kappi," exhibited by the Department of Agriculture.
(Shown for the first time in South Africa.)

under eight years and those over. Sir Lionel Phillips' Sarcelle, last year's champion, was again on view, and obtained "first" in the senior class, the second award going to the Agricultural Department's Valiant. In the junior class both awards were taken by Government stallions—Wilkins Micawber, by Mr. Alex. Robertson's Simontault, from the Department's farm at Tweespruit, securing "first," and Phoenician, a seven-year-old by Grebe—The Israelite, from Standerton, "second." The championship was secured by Wilkins Micawber, whose photograph we shall publish in next issue. First award in the Thorougbred colts class was taken by Mr. Schimpers' bay by Simonwick-Hour Glass. Mr. Nourse's chestnut, Princess Pat, by Auriform-San Patricia, took the corresponding place among the fillies, and was also awarded the yearling championship. Quite a number of useful horses competed in the class for stallions likely to beget good remounts, Bushranger, by Carbine, securing highest place. The Hackney entries were few, but the quality was good. Clydesdales were better than last year, and among other heavy types Mr. J. E. Montgomerie did remarkably well with his Suffolk Punches, which were in fine condition.

The cattle sections afforded a fine show. The number of entries exceeded those of last year by 169, and some excellent animals were on view. Most remarkable is the advance that has been made in the Friesland classes, a section which to-day occupies a position of very nearly as much importance in the judgment of the society as the whole of the cattle section did in 1907. Perhaps one of the best animals ever seen in a South African show ring was Sir George Farrar's Friesland bull Jetze, which took the championship. This animal was closely followed by a bull from the Potchefstroom Experiment Farm by Jonker II. out of Lyntje. Another bull of note was Carl II., belonging to Mr. E. B. Moore, of Johannesburg. Sir George Farrar's Bracebridge Pride took first among the young bulls. The cow section of the Shorthorns was a remarkably fine collection of animals. Sir George Farrar did well in these classes. Ayrshires were strong as regards both quality and numbers, and some very fine animals were on view. Messrs. Matthews & Watson secured first and second places in the open class for bulls with a couple of splendid animals. Herefords, too, were strong, and the Department of Agriculture carried off first honours in the open class for bulls, although they were run very close by Messrs. H. & S. Spencer's Cross-Fire. The North and South Devon sections contained a number of good animals of all classes, but the breeds were in some cases unfortunately wrongly entered, the owners being unable to distinguish the one breed from the other. The Channel Islands classes were good, and these breeds and Red Polls were well represented. Slaughter stock did not compare well with last year's, owing no doubt to the drought.

Sheep showed up well, and there was a marked increase in the number of entries as compared with last year—from 165 to 204. A great feature of this section of the show was the competition of Cape and other extra-Transvaal breeders, such as Mr. F. W. Southey, whose famous thousand-guinea ram, Magician V., attracted universal atten-

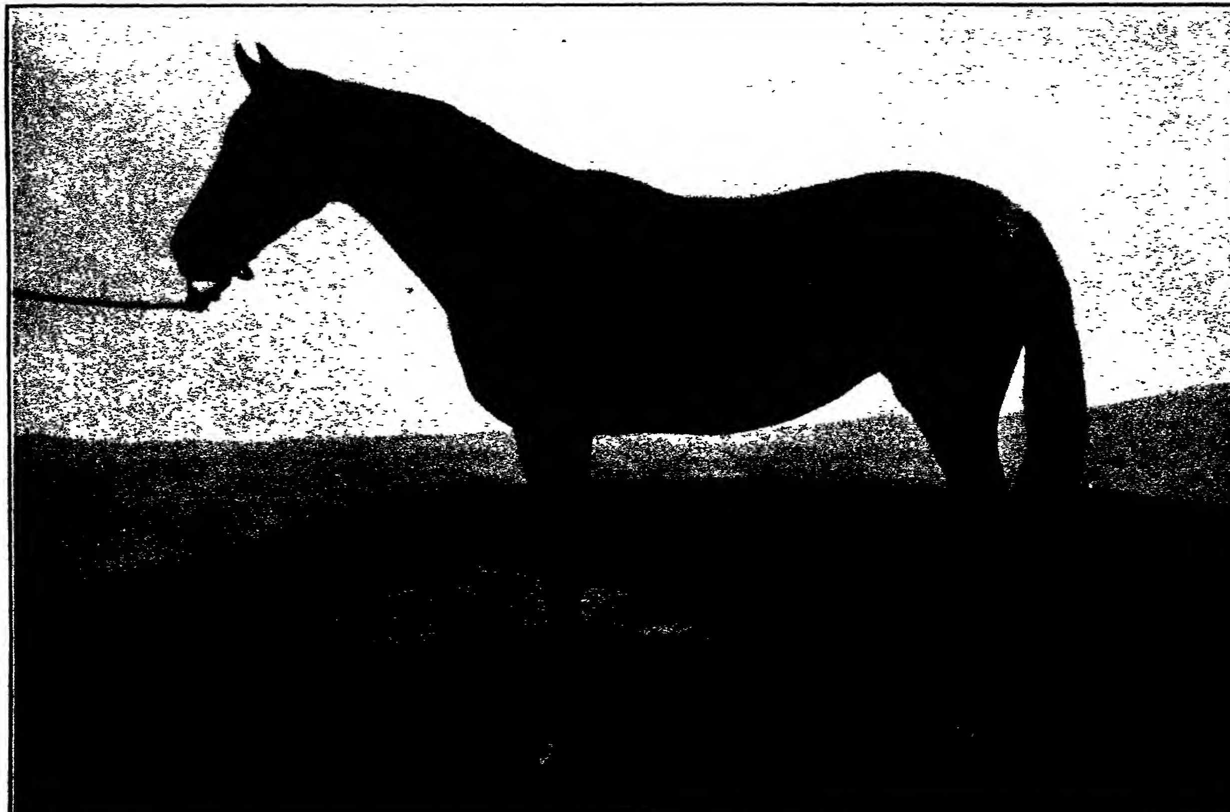


Plate No. XLV. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Mr. Henry Nourse's S.A. Bred Thoroughbred Yearling Filly "Princess Pat," by Auriform—San Patricia.
First Prize in its Class and Champion Yearling.

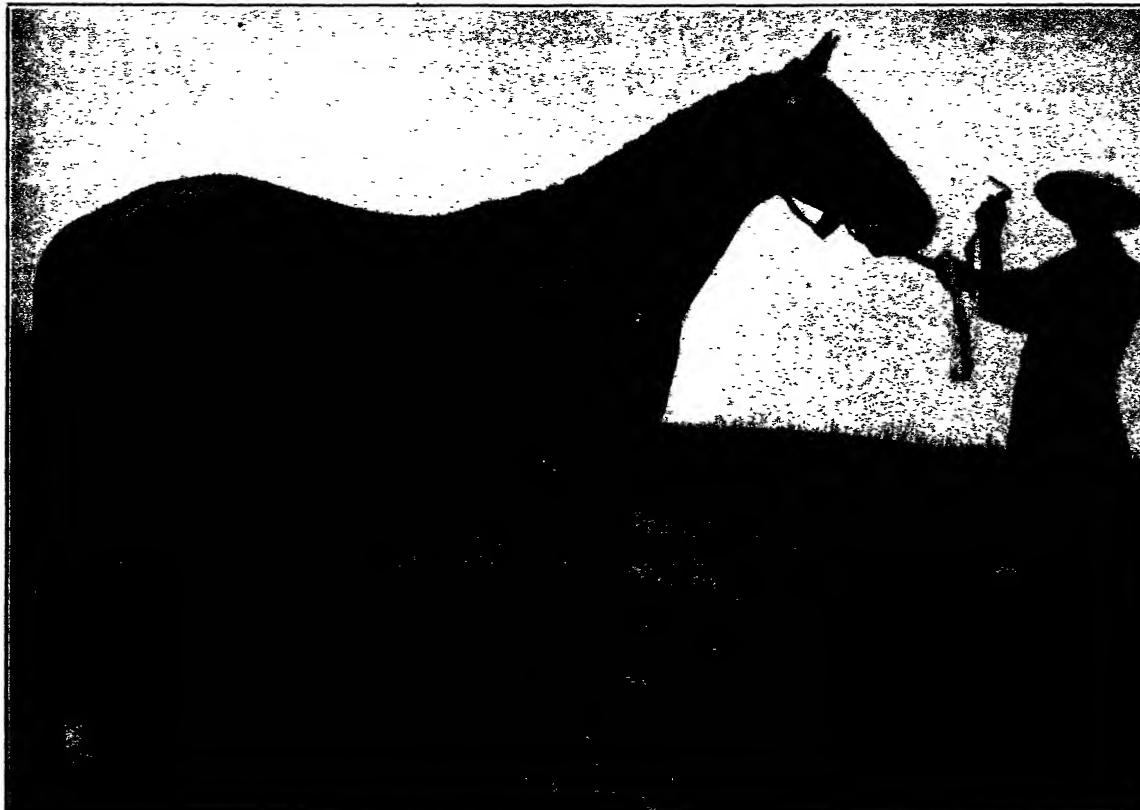


Plate No. XLVI. WITWATERSRAND SHOW. ***Photo by J. Austin Hughes.***

The Duke of Westminster's Yearling Colt "The Child." First in Class for Yearling Colts or Geldings suitable for Light Cavalry.

Plate No. XLVII. WITWATERSRAND SHOW. *Photo by J Austin Hughes.*

Sir George Farrar's seven-year-old black and white Fries Cow "Sipkje III.," by Mazeppa II.—Sipkje II.
First in Open Class, three years and over.

tion. In fact there were many well-known exhibitors from other Provinces whose names were seen in the Witwatersrand catalogue for the first time this year. Open competition of this nature is bound to have a beneficial effect upon any show and the farming interests which it represents, and the educational influence of competition of the best the country can produce cannot be placed at too high a value. Magician V., of course, had no difficulty in taking first place in the open class for rams two-tooth and over. There are no two ways about it that this ram was not only by far the finest on the show, but is also one of the finest sheep we have in the country. He is a grand animal, with a beautiful head and frame and a covering that is good in all points. Magician V. is destined to exercise a powerful influence for good upon the flocks in every district he touches, and his influence was noticeable already in the Johannesburg show, all three of the leading rams in the South African-bred class (Mr. Southey's Mystic, Mr. Vilonel's Magician VI., and another of Mr. Southey's rams) having been sired by him. Johannesburg has never seen better rams, and the ewes showed, if anything, even a greater advancement upon those of last year. Here again the influence of Magician V. was felt, the first and third in the open class for two-tooth and over being his progeny. (These were exhibited by Mr. Southey.) The second place was taken by a ewe belonging to Messrs. Adams & Son. Two more Magician ewes from Mr. Southey's farm won first and second places in the South African-bred class. Messrs. Robertson won in each of the other three classes. The Rambouillets and Wanganellas showed up well, and in these classes Mr. A. Luckoff, of Graaff-Reinet (another new exhibitor as far as Johannesburg is concerned) scored heavily. The only exhibits in the Transvaal open class were those from the Ermelo Stud Sheep farm.

In this issue we publish as many photographs of prize-winning stock as the exigencies of a monthly journal permit, and others will appear in the following number.

Rinderpest in German East Africa.

The following letter from His Excellency the Imperial Governor for German East Africa to His Excellency the Governor-General for the Union of South Africa, speaks for itself:—

"Your Excellency,—In amplification of my telegram of the 14th January, 1913, I have the honour to inform your Excellency as follows:—

"The existence of rinderpest was ascertained in September, 1912, at first in the District of Moschi, into which it was probably introduced from the Nyanza Province (British East Africa) through the north-east of the District of Muanza. A further focus of infection (Seuchenherd) was discovered at Umbulu (District of Aruscha). Thither the disease was introduced through dealers' cattle from the Muanza District, and similarly to Dodoma, where the last outbreaks took place.

"In the District of Moschi the losses were small, which is partly attributable to the immediate inoculation (*Durchimpfung*) of the infected herds. At Umbulu, on the other hand, the losses were considerably greater. There they varied between 16 and 50 per cent., and averaged 31 per cent. At Dodoma the losses apparently are still greater, but at present they cannot yet be fully computed.

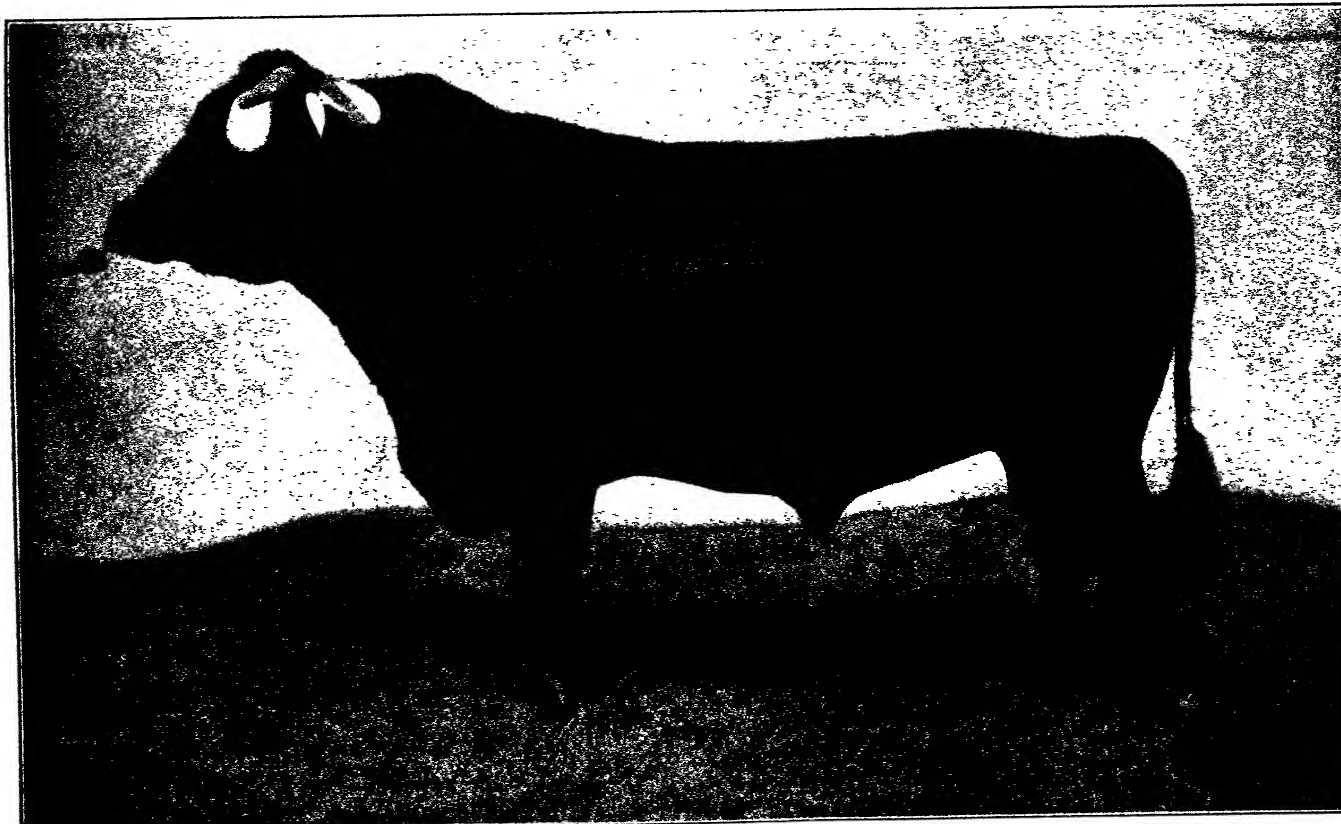


Plate No. XLVIII. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Messrs. Haggett & Ovens' Shorthorn Bull "Clenker." First in Open, S.A., and Transvaal Bred Classes, any age.

Plate No. XLIX. WITWATERSRAND SHOW. ***Photo by J. Austin Hughes.***

Sir George Farrar's Fries Bull "Jetze," 3 years 1 month, by Broeder Paul van Drieduizend—Sibbeltje IV.
Bred by Mr. J. P. Hoekstra. First in Open Class, any age.

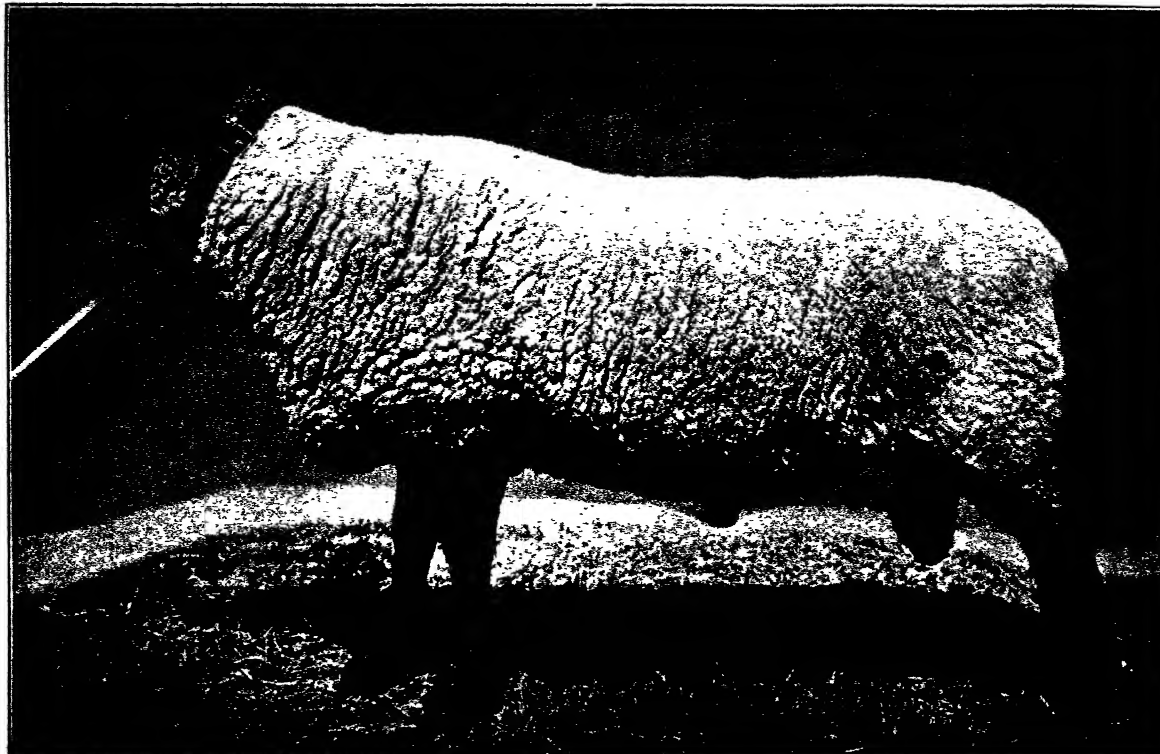


Plate No. L. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Messrs. Haggett & Ovens' four-tooth Suffolk Downs Ram. First Prize in his Class.
Bred by Department of Agriculture.

"At Moschi the disease at present has ceased to exist.

"The infected districts are closed (*gesperrt*); the cattle in them are being inoculated with serum. The results of the inoculation are satisfactory.

"Hitherto the disease has not yet crossed the line from Ruaha to the Ugalla River. In the light of previous experience, however, I regard it as not improbable that, in spite of the measures which have been taken, it will penetrate further south."

In view of the somewhat disquieting situation disclosed by the information received as to the outbreak of rinderpest in German East Africa, steps were immediately taken by the Government to check the spread of the disease into territories to the south of that country, and accordingly the introduction into the Union of any species of stock from German East Africa is now prohibited. In addition to this precaution, and on the initiative of the Principal Veterinary Surgeon, arrangements were made for a conference in Bulawayo on 10th April, 1913, at which it was hoped there would be representative veterinary officers from British East Africa, Portuguese East Africa, Belgian Congo, North-Western Rhodesia, North-Eastern Rhodesia, Southern Rhodesia, Nyassaland Protectorate, Swaziland, Bechuanaland Protectorate, Basutoland, and the Union for discussing the best methods of preventing the spread of the disease to the adjoining territories. As we go to press before the date of the conference, we are unable to publish the results of the deliberations, but it may be mentioned that, among other matters, the following points were to be discussed, namely: (1) The practicability and advisability of establishing a joint serum station in German East Africa. It will be necessary to establish the station in the territory infected with the disease, as the material for the serum will, of course, be taken from animals dying from rinderpest. (2) The expediency of arranging for a temporary loan to an invaded territory of veterinary officers of other territories. (3) The methods that should be adopted for combating the disease in varying circumstances.

Cotton Prospects in Porterville.

Mr. W. H. Scherffius, Chief of the Division of Tobacco and Cotton, writes:—Through a request from Mr. J. W. Jagger, M.L.A., who has taken a keen interest in the possibilities of developing a cotton industry in the Western Province, the Minister of Agriculture instructed me to visit the Porterville District and report on conditions and prospects as I saw them. During the month of January, 1913, in company with Mr. Roworth, I visited the district, and on our return I reported, in substance, to Mr. Jagger as follows:—We found that a number of farmers were growing cotton for the first time. Among this number we visited some of those who were reported to be making the most progress. The farmers visited were: H. S. C. Bester, Halfmanshof, via Porterville Road; F. Versfeld, Steenwerp, Porterville; R. P. Malan, Montecresto, Porterville; J. H. Basson, Oak Glen, Halfmanshof; A. I. de Waal, Halfmanshof; G. Immelman, De Tuin, Halfmanshof; and Du Plessis & Schoek, Halfmanshof. Our observations may be summed up as follows:—We found one farmer had planted a few acres (four or five) on upland and had depended

Plate No. LI. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Mr. F. W. Southey's First and Second Prize Ewe in Class for South African Bred Ewes, two tooth and over.

Plate No. LII. WITWATERSRAND SHOW. *Photo by J. Austin Hughes*

The Department of Agriculture's Wool Exhibit.

upon irrigation. Cotton requires a certain amount of moisture (preferably rain) during the growing period, whereas in this district the rain ceases about planting time or soon thereafter. This is essentially a grain district. In addition to grain soils, there are thousands of acres of land along the foothills of the mountains which, in my opinion, will produce Turkish tobacco far more profitably than cotton. The small area in vlei soils will prove more profitable for truck gardening than for cotton culture. I have no desire to write discouragingly about cotton growing around Porterville, but in my opinion there are other crops which can be produced on this soil more profitably and with less risk. If the farmers who have grown small plots, or others, ask for further advice about cotton, I will be glad to render any assistance possible.

Soybeans for Ensilage.

In one of his articles on "The Preservation and Use of Maize for Stock Feed," which are running through these pages, Mr. Burtt-Davy remarks: "Soybeans can be used for silage, but the crop is too uncertain, at present, to be relied upon, and is less satisfactory than either velvet beans or cowpeas." Mr. Bruce Hutchinson, of Sandbaken, Transvaal, has written to Mr. Burtt-Davy asking in what particular he considers the soybean unsatisfactory—whether it is because of their not growing well, or because their feeding value is not considered to be equal to other crops. Mr. Hutchinson also asks what value Mr. Burtt-Davy places on soybeans as a nitrogen collector (to be ploughed in as a green crop). Mr. Burtt-Davy's reply is as follows:—
"The only reason in my mind why soybeans may be unsatisfactory for silage are: (1) In some localities and in certain seasons the germination has been very poor, while in other places and in other seasons it has been good. This renders the crop 'uncertain,' at least at present. When we are able to obtain more local seed, I think the crop will be better and more certain. (2) The relative weight of material is usually low as compared with that of cowpeas, hyacinth beans, or velvet beans; if one is growing primarily for silage the total weight of the leguminose crop is a consideration. But in places where the soybean does well, and where the crop is grown for the seed as well, there is nothing against it for the silage pit. It is a good nitrogen collector."

Agricultural Conditions in Rustenburg.

The officer in charge of the Rustenburg Experiment Station (Mr. H. W. Taylor), in his report for February, states that the agricultural conditions in his district improved considerably during the month. The rains caused the veld grass to make considerable growth, which will be of great value to cattle owners during the coming winter. The Municipality of Rustenburg constructed a dipping tank in January, and started compulsory dipping at the beginning of February. All cattle within the municipal area are being dipped regularly every five days. Although, at the time of writing, the dip had been in operation only one month, the cattle on the town lands had improved noticeably in condition and general appearance. The late tobacco improved wonderfully during the month under review, and bids fair to be of good size and quality, though the acreage is small. Generally

Plate No. LIII.

WITWATERSRAND SHOW.

The Government Exhibits Hall.

Photo by J. Austin Hughes.

speaking, the early tobacco was not curing out as well as usual. This is no doubt due, Mr. Taylor observes, to the fact that the growth has been very slow, which resulted in a thick, tough leaf. Such leaf does not yellow uniformly in the curing sheds, and hence does not cure a uniform colour. The maize crop throughout the district is short, and the plants, as a rule, have made very poor growth. Native labour is becoming more plentiful, but the wages remain about the same.

Piet Retief in February.

Mr. R. T. Falgate, the officer in charge of the Piet Retief Experiment Station, reporting on agricultural conditions during the month of February in his district, states that, owing to warm, steady, well-distributed rains during the month, the progress of all crops has been most favourable. The district throughout was, at the time of writing, to be seen to its best advantage, and it was wonderful to note the enormous growth of crops in this short period since planting. After the severe drought, which lasted until the first week in December, things in general had a very poor outlook, and all planting was done with a very poor prospect of a good harvest, but the warm, steady rains which fell in December (7.59 inches, with 4.94 inches in January) and during February (6.91) have changed the prospect, and a good harvest is now assured. A great many farmers anticipate a better and larger harvest than they have had for years. Mr. Falgate adds: "I should like also to state here that many farmers who own land in the warmer, low-lying parts of Swaziland had large lands ploughed and planted with maize during the drought. These men, who looked ahead, anticipating a bad year, will now reap a double crop. I have not seen these crops in Swaziland, but I am informed that they are first class." The prices of produce in the Piet Retief District in February were still very high—maize (local), 25s. per sack; forage (oat-hay), 25s. per 100 bundles. A great many losses from disease have occurred, especially horse-sickness and blue-tongue, both of which diseases have been very bad this season. The East Coast fever, which broke out afresh, gave the district a scare, but is quieting down. Several tanks for dipping cattle are being erected. The farmers who already have dipping tanks are very successful so far; parts where tick fever has been bad are now clean and free from disease.

Wanganellas in Caledon District.

A correspondent writes:—"Mr. Chas. Leonard, of the Gloria Estate, Caledon, in 1908 imported thirty Wanganella ewes and ten rams from Messrs. Austen & Millear. These sheep proved to be so well suited to the Caledon District that Mr. Leonard was encouraged to make a further large importation in 1910 of 182 Wanganella ewes from the Mumbledool Estate, Narrandera, New South Wales, together with several stud rams from Messrs. Millear, one of which cost 250 guineas in Australia. Last year another stud ram was bought from Messrs. F. S. Falkiner & Sons, of Wanganella, New South Wales, for which £300 was paid. The progeny of these sheep have become very popular in the Caledon District, and rightly so, as the following prices

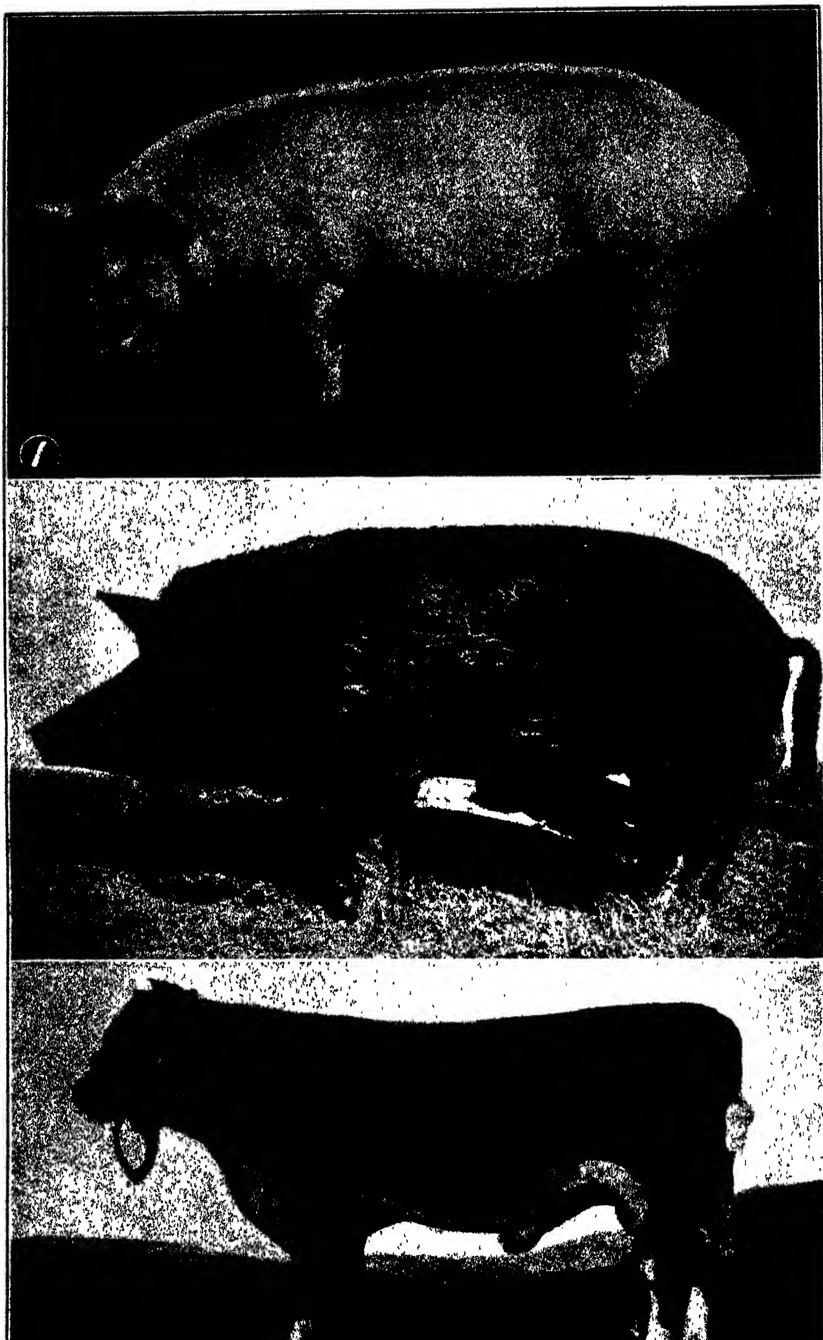


Plate No. LIV. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

1. The Salvation Army Social Farm's Yorkshire White Sow "Lady Lawley." First in Open and S.A. Bred Classes for Yorkshire Middle or Small White Sows. 2. Mr. J. Gunning's Tamworth Boar "John II." First in Open and S.A. Bred Classes. 3. Messrs. H. & S. Spencer's Hereford Bull "Czar." First in Classes for S.A. Bred Bull, any age; Transvaal Bred Bull, any age; S.A. Bred, 12 months and under 24; and Transvaal Bred, 12 months and under 24.

obtained for the Gloria clip at the January sales in London are unprecedented for Caledon wool, and prove the suitability of Wanganella sheep for the Western Province:—

	s.	d.
11 bales "A" combing	1	1
3 bales "B" combing	0	11½
17 bales "C" combing	0	11½
3 bales "rams"	0	11½
9 bales "lambs"...	0	9½
8 bales "broken"	0	10½
2 bales "A" pieces...	0	10
4 bales "C" pieces	0	9
4 bales "locks"	0	6½

The wool was shipped through Messrs. Poppe, Schunhoff & Guttery, Capetown, and Messrs. Chas. Balme & Co., the well-known firm of London brokers, report as follows:—'We were very pleased with the appearance of the wool when we examined it in bulk. The fleeces are bright and light in condition, and the staple well nourished, of good length, and thoroughly sound. The "A's" were of exceptionally good combing length and closely resemble the Riverina wool grown in Australia. The lambs were in good order and of the correct length of staple. The broken wools were a very nice lot. The bellies were large and correctly skirted, also the locks."

Dry-farming.

Mr. J. Pope-Ellis writes from Hilton Road, Natal:—"Dry-farming is such an important branch of farming in South Africa that we cannot, I think, discuss it too much, and should strive to learn from one and all points for and against the system. We know what is said of the man who is able to grow two blades of grass where one originally grew, and if it is possible for us by correspondence and in other ways to secure any valuable information on the subject I take it we are not wasting time. Twenty-six years ago I was farming in 'The Thorns,' near Maritzburg, Natal, and gave 24 acres very much the same cultivation for Kaffir corn, but in those days the agricultural implements were nothing like what we have to-day. The weeders were made of wood with only three tines, and bad at that. However, the result was that we had a very heavy crop of Kaffir corn, in spite of a very dry summer. During the last twenty-eight years I have off and on interested myself in dry-farming, and am satisfied that in our dry 'thorns' with rich land it pays. At the same time I think the 'thorn' land is most suitable for this class of farming. The season has been one of the driest in our 'thorns' for forty years, and with very little rain—in fact, only one good rain, giving 1.24 inch. Though the unploughed land is hard and dry, on the ploughed land I have great depth of moisture. With water I think we often do harm in using it, when, if we had given more cultivation and possibly no water, the crops would have been better. Cultivation *versus* irrigation is a question for us carefully to consider. It may be of interest to many to know the results of my experience. Near Bethal, in the Transvaal, some years ago I grew mealies on land that produced 3½ bags per acre. I continued planting mealies every second year, and every alternate year the stock fed on the old lands till about

March, when the weeds, etc., were ploughed under. For dry-farming I believe we must have humus. I cultivated this land more or less on the dryland principle. Though last year we had a short rainfall we reaped over 12 muids per acre without manure. Each year the crop has increased in the yield."

Pearl Millet.

We publish herewith some interesting photographs, kindly sent by Mr. George Cole-Hamilton, of Coalbrook, Orange Free State, of

TWO FINE SPECIMENS OF PEARL MILLET.
Grown by Mr. G. Cole-Hamilton.

pearl millet, otherwise variously known as African wonder grass, M'Nyati, the giant millet, a crop which Mr. Cole-Hamilton is growing for silage purposes. This plant proves remarkably drought-resistant, stools heavily, and gives a heavy crop of fodder eminently suited for making silage. Our correspondent writes:—"The crop, if left till the seed is ripe, will grow to 9 or 10 feet high. When fully grown the stems are coarse and look most unappetising, but I found last year that when well chaffed my cattle ate it readily, and that this chaff, mixed

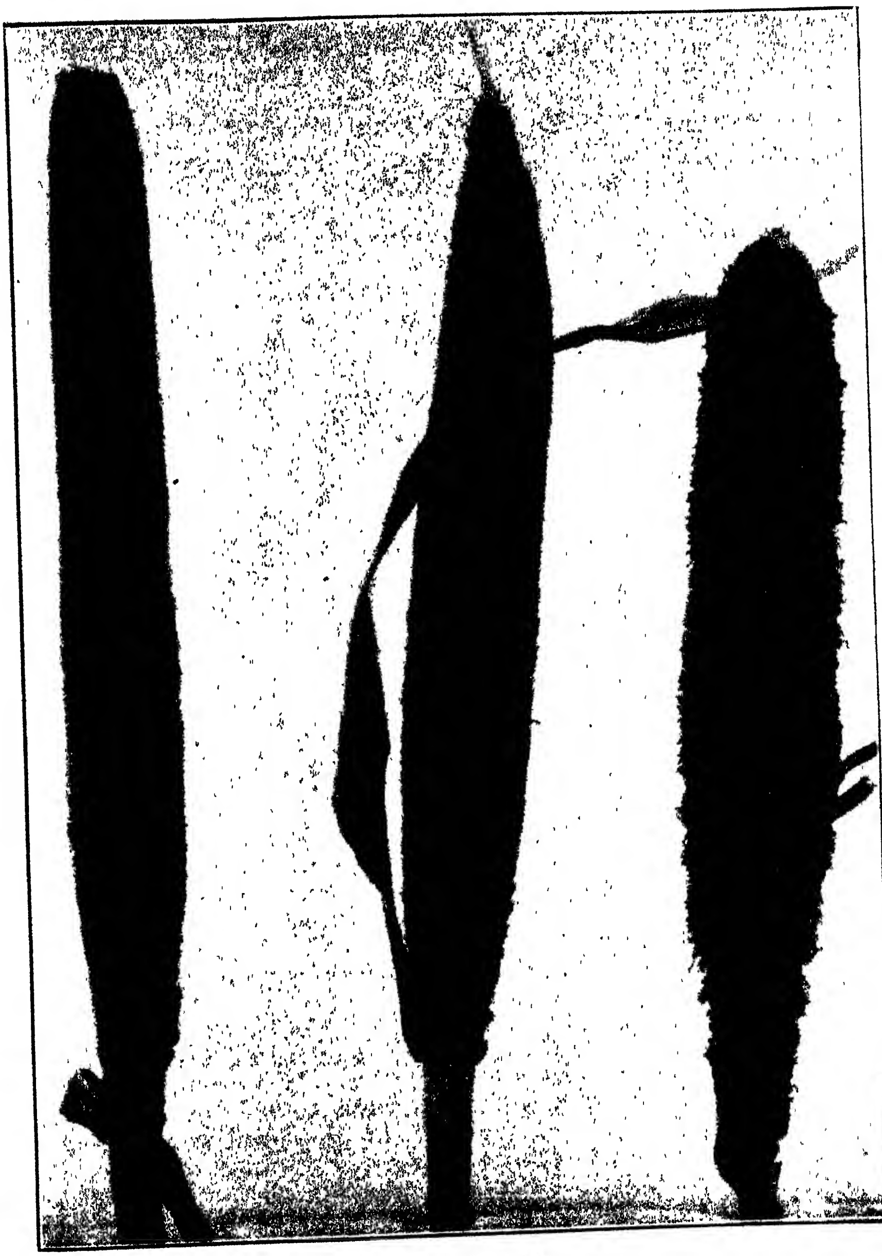


Plate No. LV.

HEADS OF PEARL MILLET.
Grown by Mr. G. Cole-Hamilton.

with the husks left after threshing, brought up my milk supply in a wonderful way. I should, from experience, recommend that the crop be cut early, long before it attains its full height, and carefully dried and saved like oat-hay. It will quickly make a second growth which will make good greèn feed or silage, and, after the second cutting, will give a nice green bite for stock until the heavy frosts. The last growth, if ploughed in as soon as the frost has caught it, is an excellent manure. If the crop is sown early—with the first rains—it will give a forage crop, a silage crop, a green feed, and a valuable manure. I have found it a most valuable smother crop for quick-grass and a splendid drought-resister. The plants shown in the photograph were grown on absolutely dry land early in the year. The pictures were taken in the middle of February; four months after sowing they had not attained their full height. . . . Pearl millet certainly is a splendid standby crop for the farmer, and should be more widely known than it has been hitherto. I am putting some on exhibition at the Johannesburg Show, and shall be very glad indeed to answer any questions by letter."

Vermin-proof Fencing.

We publish below two specifications of a wire-netting and a barbed wire vermin-proof fence respectively which we can recommend to farmers as suitable fences for vermin-excluding purposes. The specification for a vermin-proof wire-netting fence is as follows:—The fence must not be less than 4 ft. 4 in. in height from the ground to the level of the top wire. Netting 3 ft. wide, 14-gauge, and 3 to 3½ in. mesh must be used. This netting must be attached to not less than three running wires, No. 6. Above the netting must be placed not less than four barbed wires with barbs not more than three inches apart. These four wires must be set as follows:—No. 1, 3 inches above the netting; No. 2, 4 inches from No. 1; No. 3, 4 inches from No. 2; and the last 5 inches from No. 3. Running barbs must be strapped from the top wire of the fence to the plain wire at the top of the netting every 2 to 3 feet; a double strap of wire not thinner than No. 10 to be used. Droppers must be inserted every 3 to 9 feet across the entire fence. The fence must be securely packed at the bottom with stones. If this is not done 4-ft. netting must be used, of which one foot must be laid flat on the ground. The following is the specification for the barbed wire fence:—Thirteen wires must be used and set as follows: First one, 2 inches from the ground. From there up the espacement as follows, 3, 3½, 4, 4, 4, 4, 4, 4, 5, 5, 6, and 6 inches, making a total of 4 feet 6½ inches. Not less than seven 3-inch barbs must be used. If wire of 3-inch barbs only is employed an extra ½ inch may be allowed between the wires throughout. Droppers or double laces of No. 7 or No. 8 wire must be placed every 3 feet apart. Poles or standards must be, in the case of each kind of fence, 20 to 30 feet apart, depending on the pole used. The lighter the pole or standard the nearer together these must be planted.

Correspondence.

Ths section will be set aside for correspondence on all subjects affecting the Farming Industries of the Union of South Africa and cognate matters; and, while every reasonable latitude will be allowed, contributors are requested to be as concise and succinct as possible in the expression of their views.

Suggestions for practical consideration and discussion, and hints as to improved methods applicable to any branch of agriculture will be particularly welcome.

It must at all times be distinctly understood that the Department of Agriculture is in no sense responsible for the views and opinions expressed in this section.

All communications should be clearly addressed "The Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria," and written on one side of the paper only.

LAMZIEKTE.

To the Editor of the *Agricultural Journal*.

SIR,—Having read that lamziekte has killed off so many cattle and is spreading, I would like to give my experiences to see if I cannot persuade a few farmers to give my method a thorough trial.

About eighteen years ago my cattle were doing very badly. I lost as many as ten milch cows in a month with the dread disease. Just about that time Dr. Hutcheon experimented near Sandflats with bone and found it a success. I thought I would give it a trial, for I could see that, at the rate the cattle were dying, I would have none left. But where I made a mistake was, instead of buying *good* bone I collected all the bone on the farm and gave it to the cattle, which I maintain has no preventive properties, and the consequence was that the cattle continued dying. If you want to make the feeding of bone a success you must buy good sterilized bone, so that there is no fear of contracting anthrax, etc., and you must never tire of giving cattle sufficient.

Dr. Theiler, in his report on lamziekte, was puzzled to know why so many failed with bone. I think in most cases it was because it was not done thoroughly.

The milch cows I dose with a mixture of 200 lb. bone-meal, two buckets of best Zwartkops salt, and one bucket of *good* sulphur. Mix thoroughly together and give each cow 2 oz. of the mixture at back of tongue dry. See that you take out all water, or else they will refuse to swallow same. I give this dose three times a week regularly. The dry cattle get crushed bone in troughs put near the drinking places.

I have prevented lamziekte on my farm with the above method for seventeen years; and if it failed to prevent lamziekte I would still use same for condition of cattle. Several gentlemen have said mine is not a lamziekte farm; if dying at the rate of ten a month does not make it one I do not know what does.

A native came to my farm about eight years ago with nine head of cattle. At the end of the first year three died of lamziekte in one day. Since then he has been following my method, with the result that he has had no more deaths and the six cattle have increased to about forty head. The other natives that do not give bone still lose cattle with lamziekte; one lost five out of nine in one year.

Cattle coming from the Karroo districts do well for about twelve months. If it takes that time for the system to be drained of phosphates, I suppose it will take a like period to replace same. I think the experts will have to analyse the soil to get to the cause of lamziekte.

I remember the time, about thirty-five years ago, when we had thousands of sheep in the district. Lamziekte was unknown, but as soon as heartwater killed out the sheep cattle began to do badly. I firmly believe that

when the ticks are exterminated—which I hope will not take long if dipping is carried out properly—sheep will be farmed again in their thousands, and lamziekte will be a thing of the past.—Yours, etc.,

E. W. HOWARTH.

Sweet Kloof, P.O. Adelaide,
Albany, C.P.

THE FIBRE INDUSTRY IN NATAL.

To the Editor of the *Agricultural Journal.*

SIR,—Should the history of fibre growing in Natal be written it will make curious reading: for the narrative will be unique in that it will afford an interesting insight into the incompetence of and mismanagement by men who, in the past, made abortive attempts to establish the fibre aloe on the coast lands of Natal. It will be seen that, unlike coffee or cotton, whose progress in this Province has been arrested by plant disease, the aloe has been hounded out of public favour by no demerits of its own or the ban of Nature, but has been the victim of the causes alluded to; the plant has been blamed instead of the man.

Companies have been hastily raised with capital insufficient to do more than dump aloes on the bare veld, with the most primitive ideas of how to cultivate these, of where the mill site should be, and what type of machinery should be installed to deal with the mature plant. Hundreds of acres under *Furcraea gigantea* extend from the southern to the northern borders of Natal, whose owners have never made a serious attempt to exploit them. Banana syndicates, with the mill at one side of the hemisphere and the plants at the other, pineapple, insangu (hemp), and bush-vine ventures have all floated like bubbles to the surface to disappear as suddenly into the vortex of ill-considered schemes, and for these wild shots at the impossible the aloe has had to bear the penalty!

The writer has a lively recollection of an interview with one of Durban's magnates some years ago, with the view to enlisting his sympathies in the aloe industry. This gentleman had, unfortunately for the success of the new project, been victimized by a banana wild-cat scheme, with the inevitable result that my approaches were looked upon by him much in the light of a filibustering raid on the financial resources of the estimable citizens of that city. In his mind, aloes, bananas, and all other fibrous plants were an invention of the devil!

There is a good old saying, "Give a dog a bad name and hang him." A company, happily now dead, the pioneer of the fibre industry in Natal, through its bad methods of finance and its worse management, which inevitably culminated in an utter collapse, was primarily responsible for the ebbing away of all public confidence in aloes, and has done more than any of its mushroom successors to set the hands of the clock back for years as regards the restoration of that confidence. This particular company shall be nameless, but the trenchant criticism by the Press of the methods which led to that debacle will not be forgotten by those who view the slump in aloes from its true aspect.

Fortunately for the enterprise a few practical men were left whose belief in fibre production has led them to go on, in spite of depression and unbelief, and they are to-day proving by experience that if aloes are grown and milled on the same economical and practical lines as the sugar, tea, and wattle industries they are a profitable investment, and are equal to any of the standard industries named from the dividend-yielding point of view.

The firm of which the writer is a member is exporting monthly fibre bales at the rate of 100 tons per annum, the first consignment realizing £26. 10s. per ton in London (the market has risen considerably since then), and it may therefore be fairly claimed that the industry is not now on its trial, that it pays well, and is capable of almost infinite expansion along the coast lands of Natal and Zululand, which are not visited by hail or severe frosts.

The share rigger, the financial expert who bases his calculations on bearing and bulling, must, however, keep away, and the industry be run by men who intend to put in honest work and who possess a knowledge of agriculture, with the ability to apply their labour to the best advantage. Success will then assuredly be theirs, and aloes, which in the past have suffered for the sins of others, will take their rightful place as a valuable asset to South Africa alongside the older and well-established industries which, fortunately for their quick development in Natal, were not crushed down at their inception by the causes which almost strangled out fibre.

These few lines are penned merely in vindication of an enterprise of intrinsic worth which, however, until recently, has never had a sporting chance, and the writer will be amply rewarded if the causes which lay at the root of the long depression of the fibre industry in Natal be laid bare to the discerning eyes of those who recognize that no enterprise in the world can flourish if an honest endeavour be not made to work it on practical and common-sense lines.—Yours, etc.,

CLAUDE MANNING.

P.O. Izotsha, Natal.

KAFFIR CORN POISONING.

To the Editor of the *Agricultural Journal.*

SIR,—Having heard that growing kaffir corn is very poisonous to cattle I should be glad if you could inform me (1) if such is actually the case and (2) whether there is any antidote which can be used in the event of cattle getting into a land of kaffir corn and becoming poisoned thereby?

A neighbouring farmer has lost four head of cattle, which he states is due to their being poisoned by kaffir corn, and as there is a good deal of kaffir corn growing here and always a possibility of cattle finding their way into it, I shall be glad of your early reply.—Yours, etc.,

A. WEINER.

Station View, Ventersburg Road, O.F.S.

[(1) The Government Botanist (Mr. J. Burtt-Davy) replies:—Kaffir corn, while young, may be and often is poisonous to cattle, but this is not always the case, and it is impossible to tell beforehand whether or not it will be safe; therefore it is best to keep them out. (2) The Acting Director of Veterinary Research (Mr. Wm. Robertson) states:—The young kaffir corn is poisonous when the plant is under a foot high, becoming less so as it ripens. The poisoning effects are due to the production of prussic acid in the eaten plant, and death is comparatively rapid. With regard to treatment, heart and nerve stimulants are required, and amongst these ammonia and alcohol act as well as most. Give ½ oz. of powdered carbonate of ammonia and ½ pint of dop dissolved in a bottle of cold water; repeat every two hours until relief is obtained.]

MEASLES IN PIGS.

To the Editor of the *Agricultural Journal.*

SIR,—Will you please favour me by informing me whether there is a cure for measles in pigs? Is there any means of dosing them to ensure their being free from this disease when slaughtering for bacon?

What is the easiest manner of testing the animals for this disease, whilst alive?

This information, if published in your valued journal, would be highly esteemed by a great many residents in this neighbourhood.—Yours, etc.,

F. S. BISHOP.

Aberfeldy, O.F.S.

[The Veterinary Surgeon, Experimental Farm, Potchefstroom (Mr. J. B. Quinlan), replies:—Pig measles are produced by the *cysticer cus cellulosae* in the larval form of the *Taenia solium* of man. The life history of the parasite is as follows:—When the ripe ova of the *Taenia solium* arrives in the digestive canal of the pig their shell is dissolved by the gastric and intestinal juices and the embryos they contain set free. These embryos pass through the stomach or intestinal walls and are scattered—most likely by the blood stream—in every part of the body. These embryos are fully developed into cysticerci in the predilection sites in three months, and there remain until liberated by the death of the pig. If eaten by a susceptible animal (man) then they develop into adult taenia. Concerning your questions: (*a*) There is no treatment which can be prescribed for its cure. (*b*) The best and most economic treatment is preventive—continual confinement in the sty, and feeding exclusively on material free from the eggs of the adult tapeworm; such are the best, but in countries where agricultural necessities require that the pigs be sent to the pastures we must expect the disease to be maintained unless the rural population becomes acquainted with the danger that results from the dissemination of human excreta, and the necessity for well-enclosed

privies. (c) The symptoms are vague and difficult to appreciate; most frequently there are none, and especially when infestation is not general. The only one that may be accepted as indicative of measles is the presence of the *cysticer cus cellulosae* beneath the mucous membrane accessible to exploration—such as the inferior surface of the tongue, more especially at the sides of the membrane just in front of its fixed portion. Here their presence may be recognized by unevenness of the surface, due to the prominence that the vesicles form, while their transparency and form contrasts with the rosy colour of the neighbouring parts. Several other symptoms are mentioned, but in my opinion are very little use in anti-mortem diagnosis. Sometimes when affection is chronic, extensive, and generalized in the pig, he is feeble and easily tired, becomes indifferent, stiff, and later falls from prostration and ultimately dies if not destroyed. Occasionally the cysts lose their usual characteristics owing to degeneration, which may occur at any stage of their development. Then their size is about that of a millet seed, and they form elliptical nodules of a yellowish brown colour filled with purulent-looking matter. It is usually age that brings about this change. The *cysticer cus* is then lifeless. This condition is termed by pork butchers "dry measles."]

BILIARY FEVER IN HORSES.

To the Editor of the *Agricultural Journal.*

SIR,—I would be very much obliged if you would kindly inform me of the best known remedies for biliary fever in horses and if there is any preventive. Also is it advisable to give hard-worked horses tonics; if so, what would you recommend?—Yours, etc.,

A. W. JOHNSTONE.

Surbiton.

[The Senior Veterinary Surgeon, Transvaal (Mr. J. M. Christy), replies:—Biliary fever in horses is a tick-transmitted disease, therefore the way to prevent it is to keep your horses free of ticks. This can be done by periodical dipping, spraying, or hand-dressing the same as we advise for cattle to prevent East Coast fever, or by stabling and grooming to remove ticks. If you stable a horse, bed him down with anything except veld grass or hay, as ticks are in it and will get on to the horse and cause trouble no matter how well and carefully you groom him. For bedding use fine shavings, sawdust, or oat, wheat, or manna straw. Should a horse develop biliary fever he must at once be put in a clean, ventilated stable, and given at least three weeks' rest. Let him have as much clean pure water as he cares to drink, to which add daily from one to three ounces of epsom salts. Give him easily digested food, such as mash made of steamed oats and bran, or a little crushed mealies and bran made into a mash with cold water; to either mash you can add one or two ounces of salt. Green barley, lucerne, or the tops of oat forage in moderation can also be given. In the early stages an electuary may be given twice daily composed of extract belladonna one drachm, chlorate of potash one drachm, treacle two drachms, to be placed on the back of the tongue with a spoon or between the molar teeth.]

ILL EFFECTS OF WHEAT CHAFF AND LUCERNE FEED.

To the Editor of the *Agricultural Journal.*

SIR,—I have been informed by a certain party that feeding milk cows on wheat chaff tends in time to diminish the supply of milk. Will you kindly inform me through the medium of the *Journal* if this is so or not? Also, why feeding cows on lucerne has the effect of causing acute gastritis when they are not used to it as a fodder. Several persons here have lost cows lately by feeding on lucerne. Also say what is the best precaution and remedy for a cow so affected.

Thanking you,—Yours, etc.,

E. W. LINCHAM.

Douglas, C.P.

[The Principal of the Grootfontein School of Agriculture replies:—I have never known lucerne to produce the condition described. It is possible that the lucerne might be defective in some way—mouldy or not properly cured. If green lucerne is referred to I don't think it can possibly be the cause of the disease. I think it is most probable that the lucerne contains poisonous

or irritant plants which are at the bottom of the mischief caused by the feeding. In any case the treatment for gastritis would be to administer a pint of linseed oil with lime-water or an ounce of bicarbonate of soda, and to follow with ounce doses of tincture of opium twice a day in a pint of water as long as required.]

DURUM WHEAT WITHOUT RAIN.

To the Editor of the *Agricultural Journal*.

SIR,—Having seen in the January issue of the *Journal* a picture of durum wheat grown on the dry-land station at Lichtenburg without rainfall from seed-time until harvest, I should like to gain the following information:—

(i) What kind of soil it was grown on;
(ii) if it requires special manuring;
(iii) the average harvest per morgen; and
(iv) the price of seed per bag.—Yours, etc.,

M. LOTTER.

P.O. Engelbrechts Drift,
District Pretoria.

[The Dry-Land Agronomist (Mr. H. du Toit) replies.—(i) The soil on which the wheat was grown is a sandy loam and varies from six to some forty inches in depth. (ii) We manured same with kraal manure. (iii) The average yield per acre was six bags—i.e. twelve bags per morgen. (iv) The demand for seed wheat (especially durum) has been so enormous that we cannot supply even one-half of the demand. We can, however, supply Federation (a soft variety), which has done very well on dry lands even this year; price 35s. per bag of 200 lb. f.o.r. Lichtenburg; cash with order.]

THORNLESS CACTUS.

To the Editor of the *Agricultural Journal*.

SIR,—With regard to the planting of thornless cactus, before this is done on a large scale it would be desirable to know whether there is no danger of its reverting to the original thorny cactus, or prickly pear.

Is it to be understood that the fruit of the thornless cactus is also free from thorns? On many farms patches of the thorny cactus exist, so that cross fertilization might take place.—Yours, etc.,

O. BRIGG.

Herschel, C.P.

[The Government Botanist and Agrostologist (Mr. J. Burtt-Davy) replies:—Investigations conducted by the United States Department of Agriculture are reported to have resulted in demonstrating that the spineless cactus does *not* revert. The fruits of the sorts now being grown by us have some small spines; they are not *entirely* spineless.]

POTATOES.

To the Editor of the *Agricultural Journal*.

SIR,—What is the best time to earth up potatoes, or how long after they appear above the ground should it be done? How do you preserve seed potatoes so that they remain good till the next season? How long must Early Rose potatoes remain in the ground from the time that they are sown till they can be taken out for seed potatoes? What is the best kind to sell, and which yields the most? Where can they be obtained?—Yours, etc.,

G. SCHRADE.

Kakamas.

[The Agriculturist, Elsenburg Experimental Farm (Mr. P. Fowlie), replies: The best time to earth up potatoes is when the new potatoes have begun to form. Earthing up is usually done when the plants have been above ground for from four to six weeks.

To keep over potatoes for planting the best plan is to put them on the floor of a room where they will be fairly cool and quite dry. They should not be put in a high heap but spread out on the floor as much as possible. The potato tuber moth is frequently a pest in stored potatoes. If its presence is suspected the room should be thoroughly fumigated after the potatoes go in and all openings should be afterwards kept covered with fly-screen or sacking to prevent the moths getting in.

Early Rose potatoes should require about four months from planting till they are ripe enough to lift for the purpose of keeping for seed. The time varies, however, in different districts, and at different times of the year.

Pink-skinned potatoes, such as Early Rose and Sutton's Flourball, are generally preferred to white-skinned potatoes and fetch a somewhat higher price on our markets, but some of the white-skinned varieties, such as Up-to-dates, Sutton's Abundance, Langworthy, British Queen, and Scottish Triumph, give larger crops.

There are so many firms that sell seed potatoes that I do not care to mention names. The Government Experiment Farm at Potchefstroom usually have a quanity for disposal each year, for particulars of which apply to the General Manager.]

TAMWORTH LUCERNE.

To the Editor of the *Agricultural Journal*.

SIR,—May I ask, through the medium of your correspondence column, Mr. J. H. van der Walt a few questions about Tamworth lucerne? Is the lucerne grown on this one acre of land from 5 lb. of this seed a profitable crop? Or would you recommend more seed to be sown? What is your soil like and your sub-soil? What rainfall do you get and at what time? Where may this seed be purchased to-day? I have not seen it advertised. I will be very much indebted to Mr. J. H. van der Walt if he will be so good as to answer all these questions.—Yours, etc.,

E. F. RAPSON.

Weenen, Natal.

THE CARDOON
(*Cynara cardunculus*).

The following letter has been addressed to the Government Botanist (Mr. J. Burtt-Davy):—

SIR,—A few years ago, when rummaging through a parcel of seeds just received from Germany by a friend, I found a small parcel labelled Giant Spanish Artichoke. As my friend did not want them I planted three seeds, and the results have been of great interest to me, as I fancy we may possibly get a new winter fodder when the seeds of this plant are procurable in any quantity. It is quite distinct from any of the Globe Artichokes obtainable in South Africa, although I have tried several seed merchants. It seems there are two groups of artichokes: (1) *Cynara scolymus* L., the Globe Artichoke, and (2) *Cynara cardunculus* L., or Cardy, which is clutivated for the sake of its fleshy leaf stalks, which are bleached like celery and are said to be generally eaten in Spain and the Canary Islands. In distinction from the Globe Artichoke my variety is quite without thorns, grows to a height of five feet, and produces an immense crop of green winter fodder greatly relished by sheep, cattle, ostriches, and pigs. The plant is biennial, or may be perennial, flowers only the second year, dies down in February, after the seed is ripened, and starts again from the ground in April or May. In June my plants—I only had three—were eaten down to the ground by some stud sheep, but came into flower in December and are ripening their seed now.

All the time the plants had practically no water; it is true they were planted about two yards from an old dam wall, but the dam had no water for over twelve months, the treatment was very rough, as they were never watered or cultivated. Frost does not affect them, as they grow right through the winter in our karroo climate, 4200 feet above the sea-level. I have just measured a leaf of a plant sown in October, 1913—four feet long, two inches in diameter at the bottom of the stalk, sappy and luscious right down to the ground.

I believe this plant to be suitable for dry farming, and think it may do in Lichtenburg, or, rather, in the whole mealie belt. I have tried to obtain information about artichokes but have not been very successful. It seems that they are grown round the Mediterranean, in the Canary Islands, and in the Argentine, where the seeds form the basis of an oil industry. Perhaps it may be possible to find a variety even better suitable than mine, and I should be very grateful for any further information you might be able to give me.

I think we are particularly in want of some oil-bearing plant, as our way of feeding dairy cows leaves too much to the mealie, and the general ration of

protein for dairy cows in this country is far too slender. All oil-cakes are very rich in proteids, and the introduction of a suitable plant would be the making of the dairy man.

I suppose neither soya beans nor monkey nuts will grow on the high veld?—Yours, etc.,

W. HELMBOLD.

Waaihoek, P.O. Wolvespruit, O.F.S.

[Mr. Burtt-Davy replied as follows:—I know the Cardoon, *Cynara cardunculus* Linn., but have not previously heard of its having been used as a fodder plant. It is a native of the Mediterranean region of South Europe and North Africa, and the Canary Islands. It is cultivated as a vegetable, the bleached leaf-stalk and the roots being edible. The leaves are said to be employed as a substitute for rennet for curdling milk, but of this I have no confirmation. The plant is easily grown from seed, which is usually obtainable from continental (especially French and Italian) seedsmen. Linseed is doing very well in some places on the high veld. Soybeans are also doing well on several high-veld farms in the Transvaal. The season on the high veld is rather short for peanuts, but in some parts a moderate crop could be raised where the soil is suitable.]

WATER WHEELS, PUMPS, AND DAMS.

To the Editor of the *Agricultural Journal.*

SIR,—On my farm there is a stream that will fill a pipe one foot in diameter, or perhaps a little more. Is this sufficient water to work a water-wheel in order to grind corn and mealies, thrash corn and mealies, cut forage, pump up water on lands lying about 100 feet higher for irrigation, and to do other farm work? What size should the water-wheel be? Would you recommend a home-made wooden water-wheel, or would an iron wheel be better and perhaps pay in the long run? What would the price be? What kind of pump would you recommend as being the best? What size should a dam be to irrigate about fifty morgen?—Yours, etc.,

J. DE VEER.

Rietfontein, P.O. Gezina.

[The Lecturer in Engineering at the Potchefstroom School of Agriculture (Mr. W. S H. Cleghorne) replies:—Mr. De Veer does not give enough data to enable me to answer his questions directly. Before water can be employed to drive a water-motor, a fall in the stream is necessary, which fall must be sufficient (not less than 6 feet for a water *wheel*) and must occur in a short enough length of the stream to render the cost of installation practicable. Failing such a fall or rapid, if the stream passes with a fair amount of longitudinal fall through a valley with fairly steep sides, or flows alongside of a hill, the possibility of making an artificial fall should be considered. This may be accomplished by leading a furrow out of the stream along one side of the valley or along the side of the hill. The furrow should have a lesser longitudinal slope than that of the stream, the former therefore rises gradually higher than the latter. When sufficient difference of level has been obtained, the water from the furrow may be led to the water-wheel. When the water has done its work on the wheel it is discharged into the tail-race at a level only slightly higher than that of the stream. The site of the wheel may be arranged to be at a convenient place by leading the furrow out of the stream at a place chosen accordingly. Before the power available for a certain fall can be calculated, the amount of water which can be passed to the wheel must be experimentally determined, by a gauging weir or other method. This method is fully explained in Bulletin No. 3 of the late Transvaal Irrigation Department, which also deals with many of the questions put by Mr. De Veer, including the relative merits of different kinds of pumps.

A popular misconception seems to exist as to the amount of water which can be pumped from a stream by the power of that stream. The pumping plant in question may consist of a water-wheel driving a pump, a water-turbine driving a pump, or a hydraulic ram. Let us suppose the pumping plant used to be perfect, then, with a 20-foot fall one-fifth of the total flow of the stream would be pumped to a height of 100 feet above tail-water level. Since, however, no pumping plant is perfectly efficient, this amount will be reduced. Assuming an efficiency of 50 per cent. for the plant, then 50 per cent. of one-fifth, or one-tenth of the water would be pumped 100 feet. If the fall were 10 feet, then one-twentieth would be pumped 100 feet, and if the fall were 40 feet,

one-fifth would be pumped 100 feet. A wheel of wood and iron combined might be constructed, but an all-metal wheel would, of course, be more satisfactory and durable. To irrigate 50 morgen would require a *constant* flow from the pump of 15,000 gallons per hour. The size of storage dam would depend on the regularity or otherwise with which pumping could be carried on.]

CLOSER SETTLEMENT AND SMALL HOLDINGS.

To the Editor of the *Agricultural Journal.*

SIR,—I have already replied privately to Mr. J. J. de Villiers' interesting letter in last month's *Journal*, and told him where he might get Kropotkin's "Fields, Factories, and Workshops," but, as I had some difficulty in getting this book for myself, it might interest others to know where to get a cheap edition.

The above book does not answer two of Mr. De Villiers' questions, i.e. "What is to become of their children?" and "Is land sold at above its economic value?" Those interested in these questions, and I hope all your readers are, should read "Progress and Poverty" by Henry George.

Both these books may be obtained at 1s. 3d. each, post free, from Land Values Publication Department, 376-377 Strand, London, in cloth, or both together may be had in paper covers for the same money.—Yours, etc.,

MATHEW SMITH.

Barberton.

SORREL OR STEENBOKZUURING.

To the Editor of the *Agricultural Journal.*

SIR,—In reply to an inquiry from Mr. Laing Nava as regards the destruction of steenbokzuuring, I have been troubled with it for the last thirty years, and the only remedy I have found is to manure the land well with manure from the kraal. My land was covered with it to such an extent that the ground became difficult to plough. I manured the land very thickly, and now there is not one plant to be seen in the land. The remedy looks very suspicious but it is a sure cure. If any farmer should try this I will be very pleased to know the results.—Yours, etc.,

J. HART.

Ronan, Xuka Drift, Elliot, C.P.

FRISKY MARES.

To the Editor of the *Agricultural Journal.*

SIR,—In your journal of this month I see an inquiry with regard to a mare that kicks in the veld. By putting kicking straps on such horses it stops them. The kicking straps are put on thus:—Put a strong strap round the girth close behind the shoulders; the strap must have a ring sewn into it, placed underneath on the breast. A rope is passed through the ring and fastened to the hind feet between hoof and fetlock, not too tightly, but the rope through the ring to feet must be taut, yet not enough to interefere with the horse moving, as it must move backwards and forwards. If put on properly horses can go to grass or be used in harness or stand in stable. After it has been used for some time and they find they cannot kick, just two short bits of rope tied around the feet is sufficient without the straps or rings.—Yours, etc.,

C. S. B.

Kafirdam, P.O. Immigrant Station.

REMOVAL OF TREE STUMPS.

To the Editor of the *Agricultural Journal.*

SIR,—In the January issue of the *Journal* J. H. Human asks for cheapest means of doing this.

When clearing the bush, let him either chop or preferably saw the tree clean off about 1 foot from ground and then bore a 1½-inch augur hole into the stump 6 inches to 12 inches deep. Fill this with powdered saltpetre and plug hole with a piece of round wood driven in tightly.

In five or six months, when the sap has dried up he can set fire to the stump, when he will find it will burn clean out right to the roots 4 or 5 feet deep under ground.

By this means he will avoid heavy cost of grubbing and leave no roots to catch the plough. This plan will not work on old dry stumps, as it is the fall of sap which carries saltpetre completely through the parts of the tree.—Yours, etc.,

W. A. JONNES.

Brits.

P.S.—I have proved the above on my own farm. In fact we invariably do it when wanting to use the lands for cropping.

CROSSING RIVERS.

To the Editor of the *Agricultural Journal*

SIR,—One so often reads of drowning accidents in crossing rivers up-country in South Africa that I am surprised something has not been done to obviate this. I know the unpleasantness of crossing when uncertain if the current is too strong. It strikes me that a very easy system would be to fasten a strong wire rope from bank to bank so that one could at least have a very good chance of escape if carried away above the rope, or one could go along holding at it. May I ask what reasons there are, unknown to me, which evidently prevent the adoption of this plan to save life, or rather to prevent life being needlessly sacrificed?—Yours, etc.,

T. B. BLATHWAYT.

Capetown.

The Weather.

By C STEWART, Chief Meteorologist.

THE mean air temperature over the Union during the month of February was about one degree above the normal. Over the central portion the day temperatures were slightly lower than usual, but with this exception both day and night temperatures were higher.

The rainfall was far more satisfactory than during the preceding months, having been about normal in the Transvaal and the Orange Free State, while in other parts of the Union excesses were general, varying from about 2 per cent. over the Cape Peninsula to 390 per cent. at Maritzburg. The rains were well distributed throughout the month.

MAY WEATHER CHARACTERISTICS.

Over the Cape peninsula precipitation is now increasing rapidly, and an average of about 5 inches may be expected: rainfall is now at its maximum—about 1·5 inches—along the west coast, whilst along the south coast there is a slight increase over the preceding month. The month of May is sunny and dry, and in all parts of the Union the rainfall should hardly exceed an inch, with the exception of those areas previously mentioned, together with Swaziland and Zululand. The mean daily temperatures are still decreasing rapidly, and particularly over the Karroo, the Orange Free State, and Basutoland. Over the high veld and the Karroo radiation frosts occur and killing frosts may be expected. The highest mean temperatures now occur over Natal, where the average is 61°; the southern coastal districts following with 60°: the western, south-western, and south-eastern districts with 59°; the south-west of the Cape Province and the southern and east-central Karroo with 58°; Kaffraria and the Cape northern border with 57°; the Transvaal with 54·0°, the west-central Karroo with 53°; Basutoland, the northern Karroo, and the north-east of the Cape with 52°; and the Orange Free State with 51°

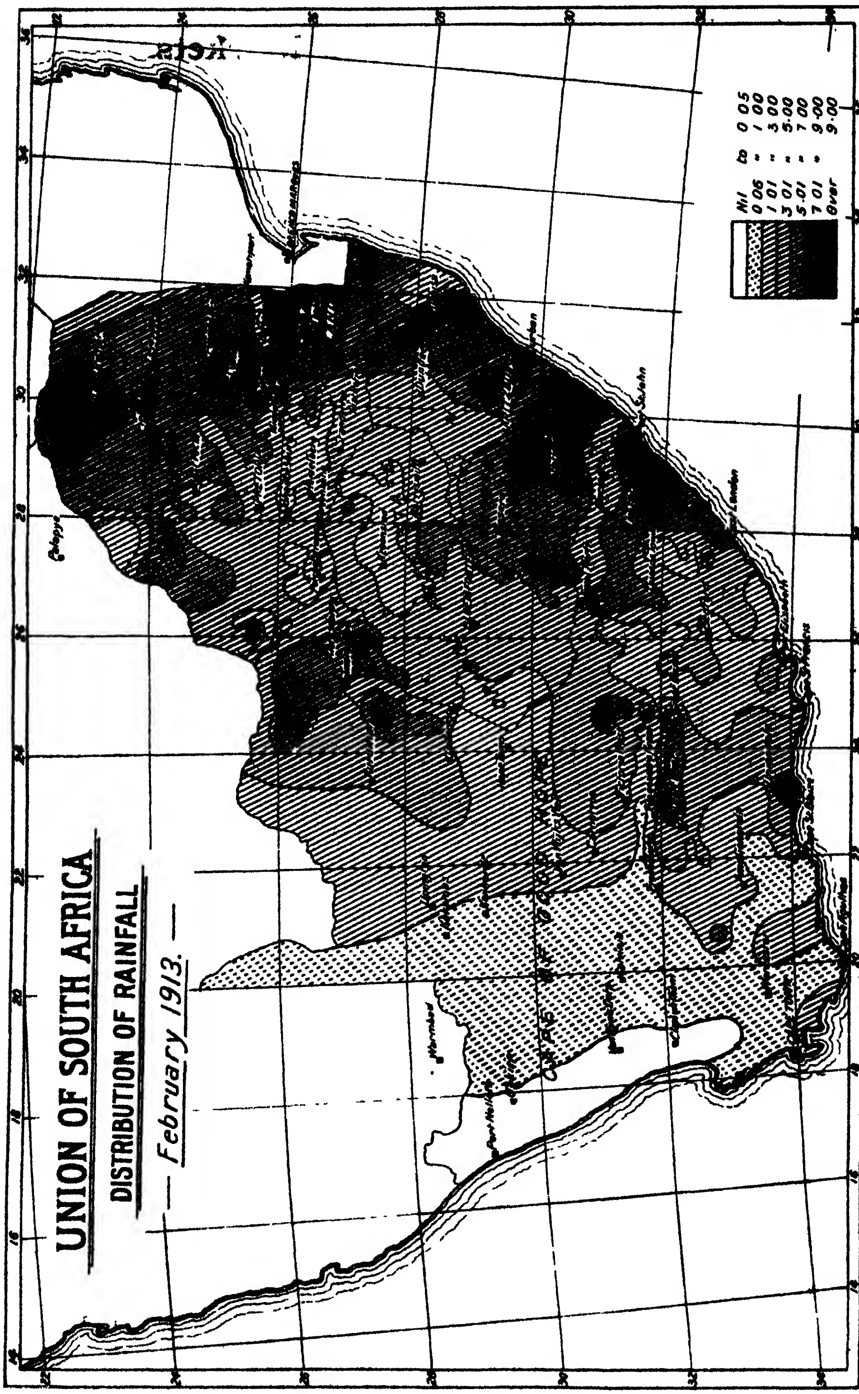
In the south-east of the Cape Province there is a decrease of winds from all directions having an easterly component, and of south-west winds, but an increase of northerly and all winds having westerly components, particularly of those from the north-west, although those from west-south-west have a slight excess over the other directions; over the Cape Peninsula north-westerly and southerly winds are about equally frequent; while over the northern border there is a marked increase of winds from south and east-north-east, together with a decrease of all winds from the north round by west to west-south-west as well as of south-east winds; the winds from the south are slightly in excess of those from east-north-east, which constitute the principal directions during this month.

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN THERMOMETER SCREENS)—FEBRUARY, 1913.

Place.	Observer.	Month—February, 1913. Mean Max.	Mean Min.	Monthly Temperature.	Normal Monthly Temperature.	Difference from Normal.	Extremes. Highest.	Date.	Lowest.	Date.
		°	°	°	°	°	°		°	
Transvaal—Louis Trichardt ...	Sergt. J. C. N. Clark	82·0	64·0	73·0	69·9	+3·1	94·5	2nd	60·0	5th.
Pietersburg	W. Frankleyne ...	81·8	61·4	71·6	69·6	+2·0	93·0	2nd	56·0	21st.
Zeerust	H. Dietrich... ...	84·6	62·5	73·5	72·6	+0·9	97·3	10th	54·6	24th.
Pretoria (Arcadia) ...	J. Lyall Soutter ...	84·3	60·2	72·3	70·8	+1·5	94·9	10th	56·6	18th.
Johannesburg (Obser.)	Staff	76·0	55·8	65·9	64·4	+1·5	81·8	27th	50·2	21st.
Potchefstroom ...	J. R. Stenning ...	84·9	59·9	72·4	69·8	+2·6	93·7	10th	52·0	25th.
Christiana	S. W. Davis ...	86·7	62·0	74·3	73·8	+0·5	95·0	12th	54·0	25th.
Free State—Bloemfontein	H. Arndt	81·0	60·2	70·6	71·2	—0·6	90·0	1st	54·5	24th
Lindley	J. Oates	—	—	—	68·4	—	—	—	—	—
Harrismith	J. B. Patterson ...	73·8	52·7	63·2	64·6	—1·4	85·0	9th	48·0	20th, 22nd, & 25th.
Cape—Hanover	W. J. Myburg ...	82·4	63·2	72·8	69·4	+3·4	92·0	1st	52·0	28th.
Aliwal North	A. Brown	82·8	56·2	69·5	69·2	+0·3	91·0	1st, 18th, & 19th	49·5	11th.
Kokstad	H. D. Coyte ...	77·0	56·0	66·5	66·4	+0·1	86·8	9th	47·1	4th.
Murraysburg	A. Cameron ...	83·8	58·7	71·2	70·8	+0·4	94·0	1st & 17th	52·0	2nd.
Queenstown	H. Holley	82·9	60·4	71·6	69·9	+1·7	96·0	1st, 9th, & 18th	53·0	25th.
East London	M. G. Grogan ...	79·3	65·3	72·3	69·5	+2·8	83·0	10th	61·0	4th.
Amalienstein	Rev. Paul Prozesky	87·7	63·3	75·5	75·0	+0·5	99·0	26th	54·0	22nd.
Groot Drakenstein ...	Lionel Baker ...	86·9	64·6	75·7	72·7	+3·0	98·5	12th	57·4	27th.
Capetown (Observat'ry)	Staff	80·4	63·5	71·8	69·7	+2·1	95·1	4th	56·2	17th.
Wynberg	Sister Mary Imelda	80·3	60·8	70·5	68·8	+1·7	94·5	5th	54·0	20th.
Mossel Bay	G. Draper	76·7	63·0	69·8	69·6	+0·2	82·0	18th	56·0	1st.
Port Elizabeth ...	P. E. Morgan ...	77·3	64·4	70·8	69·8	+1·0	84·0	18th	60·0	20th.
Natal—Durban	A. J. O. Andreasen	78·0	71·3	74·6	—	—	81·0	23rd	65·0	4th.
Dundee	Gaoler	82·8	61·4	72·1	69·9	+2·2	94·0	1st & 9th	55·0	21st.
Maritzburg	Natal Asylum ...	85·0	62·0	73·5	73·4	+0·1	98·0	1st	57·0	4th & 26th.
Hlabisa	E. D. Lightening ...	84·3	68·0	76·1	—	—	96·0	9th	63·0	26th, 27th, & 28th.

RAINFALL RETURN FOR FEBRUARY, 1913.

PLACE.	OBSERVER.	MONTH.			YEAR.		
		Feb., 1913.	Normal.	Difference from Normal.	From 1st Jan., 1913.	Normal.	Difference from Normal.
Transvaal—		ins.	ins.	ins.	ins.	ins.	ins.
Komatipoort	H. J. Evans	5·27	4·50	+0·77	5·43	8·88	−3·45
Christiana	S. W. Davis	4·86	4·12	+0·74	7·79	7·05	+0·74
Belfast	G. J. Imrie	2·34	3·45	−1·11	9·69	9·86	0·17
Pilgrims Rest	E. Elphinstone	9·34	7·73	+1·61	13·22	15·74	2·52
Zeerust	H. Dietrich	5·12	4·64	+0·48	6·99	9·23	2·24
Middelburg	Dr. H. A. Spencer	2·28	4·16	−1·88	6·95	9·43	−2·48
Potchefstroom	H. R. M. Bosch	3·66	4·55	−0·89	4·71	8·76	−4·05
Pretoria	J. Lyall Soutter	6·58	4·90	+1·68	12·12	10·84	+1·28
Rustenburg	Transvaal Police	3·27	4·55	−1·28	5·83	9·60	−3·77
Standerton	A. von Backstrom	5·89	6·39	−0·50	9·28	10·92	−1·64
Pietpotgietersrust	Transvaal Police	5·40	3·52	+1·88	9·01	8·76	+0·25
Johannesburg	Observatory Staff	3·08	4·76	−1·68	5·74	10·37	−4·63
Louis Trichardt	Sgt. J. C. M. Clark	10·43	6·44	+3·99	12·58	11·53	+1·05
Pietersburg	W. Frankleyne	5·40	3·51	+1·89	9·10	7·34	+1·76
Swaziland—							
Mbabaan	Swaziland Police	11·75	7·59	+4·16	17·54	16·83	+0·71
Natal—							
Durban	A. J. O. Andreason	11·26	4·51	+6·75	17·60	9·11	+8·49
Maritzburg	Govt. Asylum	12·76	3·28	+9·48	19·17	8·90	+10·27
Dundee	The Gaoler	4·55	4·85	−0·30	10·18	11·41	−1·23
Hlabisa	E. D. Lightening	4·89	4·99	−0·10	13·80	10·26	+3·54
Port Shepstone	A. B. Cox	9·00	5·06	+3·94	11·17	8·88	+2·29
Bulwer	A. Brown	8·99	—	—	18·26	—	—
Cape—							
Mafeking	A. Webster	2·78	3·23	−0·45	6·76	6·61	+0·15
Vryburg	J. T. Morrison	4·69	5·63	−0·94	5·59	12·88	−7·29
Griquatown	E. Hanstein	3·93	2·26	+1·67	4·84	4·29	+0·55
Prieska	M. Drummer	2·31	1·38	+0·93	3·61	2·64	+0·97
Fraserburg	P. J. Booysen	4·00	0·88	+3·12	4·06	1·69	+2·37
Clanwilliam	W. J. Downes	0·00	0·32	−0·32	0·00	0·55	−0·55
Calvinia	W. Harvey	0·25	0·49	0·24	0·35	0·80	−0·45
Piquetberg	A. H. Morris	0·00	0·58	−0·58	0·58	1·09	−0·51
Britstown	P. A. Myburg	4·06	1·49	+2·57	4·36	2·41	+1·95
Carnarvon	J. Sullivan	2·29	1·35	+0·94	2·50	2·71	−0·11
Murraysburg	A. Cameron	1·91	1·94	0·03	2·49	3·32	−0·83
Hanover	W. J. Myburg	3·52	2·37	+1·15	4·01	4·14	−0·13
Aliwal North	A. Brown	3·77	4·07	0·30	5·30	7·72	2·42
Queenstown	H. Holley	6·71	4·01	+2·70	9·31	7·94	+1·37
Kokstad	H. D. Coyte	6·76	3·61	+3·15	12·15	8·29	+3·86
Port St. Johns	F. J. Lloyd	10·63	6·26	+4·37	17·68	10·25	+7·43
Worcester	W. B. Sutton	0·30	0·36	−0·06	0·30	0·74	−0·44
Capetown Observ.	The Staff...	0·84	0·61	+0·23	1·22	1·43	−0·21
Wynberg	Sister Mary Imelda	1·50	0·71	+0·79	1·99	1·70	+0·29
Amalienstein	Rev. Carl Prozesky	1·21	1·30	−0·09	1·69	2·37	−0·68
Swellendam	H. Montgomery	1·85	2·42	0·57	2·04	5·14	−3·10
Mossel Bay	G. Draper	0·97	1·38	−0·41	1·84	2·45	−0·61
Beaufort West	W. T. Golledge	2·23	1·20	+1·03	3·33	2·28	+1·05
Uniondale	E. J. Stewart	1·71	1·00	+0·71	2·59	1·84	+0·75
Knysna	Chas. Wilding	2·48	2·03	+0·45	2·70	4·22	−1·52
Graaff-Reinet	J. A. Simpson	4·62	1·91	+2·71	5·43	3·69	+1·74
Steytlerville	P. R. de Wet	4·90	1·15	+3·75	6·09	2·06	+4·03
Port Elizabeth	P. E. Morgan	1·79	0·83	+0·96	2·66	2·06	+0·60
Bedford	T. C. Hall	4·78	3·50	+1·28	7·51	6·78	+0·73
East London	Capt. M. G. Grogan	6·18	2·16	+4·02	8·35	4·55	+3·80
Hopetown	C. B. Scott	1·69	1·81	0·12	2·37	3·89	1·52
Orange Free State—							
Bloemfontein	H. Arndt...	4·92	3·45	+1·47	6·44	7·52	−1·08
Harrismith	J. B. Patterson	2·74	4·27	−1·53	7·40	9·32	−1·92


UNION OF SOUTH AFRICA
DISTRIBUTION OF RAINFALL
— February 1913. —
Nil to 0.05
0.06 " 1.00
1.01 " 3.00
3.01 " 5.00
5.01 " 7.00
7.01 " 9.00
Over 9.00

South African Produce Markets.

CAPETOWN.

The Produce Department of the firm of R. Müller, Capetown, reports under date of the 28th March, 1913, as follows :—

Ostrich Feathers.—Since my last report no sales have taken place in London.

The local market was fairly well supplied. Comparatively large parcels changed hands, both by public auction and out of hand, realizing satisfactory prices, decidedly in favour of sellers.

The Capetown market can take up any quantities. There is a special demand for all superior classes. However, there is no difficulty here in disposing of any species, both for local manufacture and for export.

Prices now ruling are as follows : –

	£	s.	d.		£	s.	d.
Primes	17	0	0	to	28	10	0
First	10	10	0	„	15	10	0
Second whites	8	10	0	„	10	10	0
Third whites	4	10	0	„	6	10	0
Inferior and stalky whites	2	10	0	„	3	10	0
Byocks and fancy	3	0	0	„	10	0	0
Superior feminas	12	10	0	„	16	10	0
First feminas	8	10	0	„	10	10	0
Second feminas	6	0	0	„	7	10	0
Third feminas	2	10	0	„	4	0	0
Greys	3	10	0	„	9	0	0
White boos	2	0	0	„	4	10	0
Light boos	1	5	0	„	2	10	0
Dark boos	0	5	0	„	0	15	0
Inferior boos and tipless	0	5	0	„	1	5	0
Long blacks	3	0	0	to	6	0	0
Medium blacks	1	10	0	„	2	10	0
Short blacks	0	5	0	„	0	15	0
Long floss blacks	1	10	0	„	2	10	0
Medium floss blacks	0	17	6	„	1	5	0
Short floss blacks	0	5	0	„	0	10	0
Long drabs	2	0	0	„	3	0	0
Medium drabs	0	10	0	„	1	15	0
Short drabs	0	2	6	„	0	7	6
Long floss drabs	1	10	0	„	2	10	0
Medium floss drabs	0	17	6	„	1	5	0
Short floss drabs	0	1	0	„	0	10	0
Inferior long blacks and drabs	0	15	0	„	2	0	0
Common blacks and drabs	0	1	0	„	0	5	0
Spadonas	1	0	0	„	4	0	0

Wool.—At the recent London sales 143,500 bales were offered, whereof 5900 were from the Cape. Bidding proved animated, both for the English and Continental demands. Australian and New Zealand merinos experienced an advance up to 5 per cent. Cross-breds rose up to 10 per cent. Full prices were paid for all Cape wools. The competition was specially strong for Cape grease wools of better grades. Merinos were bought ½d. dearer, also coarse wools advanced ½d. Cape snow-whites rose 1d. Heavies partly receded ½d.

Only small quantities were offered for sale in the Capetown market at firm prices. The local competition remains satisfactory.

The following are to-day's Capetown quotations : –

	d.		d.
Calvinia, long	6¼	to	7
Calvinia, medium	6	„	6½
Karroo and Roggeveld	6	„	9⅞
Short burry wools, heavy	4	„	4¾
Short burry wools, light	4¾	„	5½
C. and C., best grease	4¾	to	6
C. and C., medium	3½	„	4¾
C. and C., inferior	1	„	3
Malmesbury	5¾	„	6¾

Skins.—At this month's London sales 251,000 sheepskins were offered, of which 201,000 were sold. Prices throughout remained firm. Short wool skins advanced ⅛d. Of 128,000 Cape glover's skins 62,000 were disposed of. Large and good quality skins were somewhat neglected. But, for all that, the Capetown market for skins remains steady, with the exception of large Capes, which are now 3s. 1d.

Capetown exporters take up readily skins in any quantity, and are now paying as follows, namely :—

Goatskins, light	13½d. per lb.
Goatskins, heavy	11½d. per lb.
Sundried and kids	8d. per lb.
Angoras	7d. per lb.
Angoras, bastard	10d. per lb.
Angoras, shorn	5½d. per lb.
Caledon	7¼d. per lb.
Longwools, Karroo	6¾d. per lb.
Shortwools	5¼d. per lb.
Pelts and damaged	4½d. per lb.
Capes, large	3s. 1d. each.
Capes, medium	2s. 6d. each.
Capes, cut	1s. 6d. each.
Capes, damaged and lambs	9d. each.

Hides.—The demand in this market is exceptionally strong at 10d. per lb. for sound hides, whilst 7d. to 8d. per lb. is paid for damaged hides.

PORT ELIZABETH.

Messrs. John Daverin & Co. report as follows under date 29th March:—

Ostrich Feathers.—On account of the Easter Holidays no market was held this week It is intended to hold a sale next week, but in all probability it will only be a short one, as the London sales open on Monday, and it is also our Agricultural Show week.

There is some inquiry out of hand, principally for common to ordinary qualities of wings. Superior whites and feminas are not saleable out of hand, except at reduced prices. This is an indication of the general expectations as regards the London sales.

Our London correspondents report an increased trade in common wings, etc., which are used for making "fancy mounts," and the prices of all the common up to average grade are expected to advance (some advance has, of course, been disowned here). The trade is taking less of the best qualities, and as a large proportion of the offerings at the sales will consist of this description, some decline on primes and superior feminas is anticipated.

New goods are now coming to hand more freely, and stocks in town are beginning to increase.

We quote the following as current prices for:—

	£	s.	d.		£	s.	d.
Primes:							
Extra super	30	0	0	to	40	0	0
Good	17	10	0	„	25	0	0
Whites:							
Good to super	10	0	0	„	15	0	0
Good average	8	0	0	„	9	0	0
Average	6	0	0	„	7	10	0
Common and narrow	3	15	0	„	5	5	0
Good broken	7	10	0	„	10	0	0
Thirds	2	5	0	„	4	10	0
Fancies:							
Good	5	10	0	„	7	0	0
Ordinary	4	0	0	„	5	0	0
Feminas:							
Super	10	10	0	„	14	0	0
Good average	7	0	0	„	8	10	0
Average	4	10	0	„	6	0	0
Common and narrow	2	5	0	„	3	15	0
Good broken	5	0	0	„	8	0	0
Thirds	1	10	0	„	2	15	0
Greys:							
Good	4	15	0	„	7	0	0
Ordinary	2	15	0	„	4	0	0
Tails:							
Male, good, big, bold	2	10	0	„	4	0	0
Male, good average	1	15	0	„	2	5	0
Short and narrow	0	17	6	„	1	10	0
Female, light, good, big, bold	2	0	0	„	3	0	0
Female, light, good average	1	10	0	„	1	15	0
Female, light, short and narrow	0	10	0	„	1	0	0
Tails—(contd.):							
Female, dark, good, big, bold	1	0	0	to	1	15	0
Female, dark, good average	0	15	0	„	0	17	6
Female, dark, short and narrow	0	7	6	„	0	12	6
Blacks:							
Long (special)	4	10	0	„	6	10	0
Long, good	3	0	0	„	3	15	0
Long, fair	1	15	0	„	2	10	0
Long, drabby	1	0	0	„	2	5	0
Medium	1	5	0	„	2	5	0
Short	0	10	0	„	0	15	0
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Drabs:							
Long, special	2	15	0	„	4	5	0
Long, good	2	0	0	„	2	10	0
Long, fair	1	5	0	„	1	15	0
Medium	0	17	6	„	1	10	0
Short	0	5	0	„	0	12	6
Wiry	0	1	0	„	0	2	6
Floss, long	1	2	6	„	1	12	0
Floss, short	0	9	0	„	0	14	0
Spadonas:							
Light (special)	4	0	0	„	6	0	0
Light, fair to good	2	0	0	„	3	10	0
Light, narrow	0	17	6	„	1	15	0
Dark	1	0	0	„	2	10	0
Chicks	0	1	6	„	0	5	0

The following may be quoted as the approximate current values of unsorted parcels per line:—

	Whites.							*Feminas.*						
	£	s.	d.		£	s.	d.	£	s.	d.		£	s.	d.
Superior pluckings	8	10	0	to	10	10	0	6	10	0	to	8	10	0
Good average lots	6	10	0	„	7	10	0	4	15	0	„	5	10	0
Poor average lots	5	0	0	„	6	0	0	3	5	0	„	4	0	0
Common lots, stalky, narrow, and discoloured	3	15	0	„	4	10	0	2	5	0	„	3	0	0

	Tails.					*Blacks.*					*Drabs.*					*Spadonas.*				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
Good	30	0	to	40	0	20	0	to	40	0	17	6	to	30	0	50	0	to	80	0
Average	17	6	„	25	0	12	6	„	15	0	10	0	„	12	6	35	0	„	50	0
Poor	10	0	„	15	0	8	0	„	10	0	6	0	„	7	6	20	0	„	30	0

It will be understood that for special lots these quotations may be exceeded.

Wool.—There were no public sales held here this week, as the Market Halls are taken up with the festivities in connection with the Show; neither will there be any sales next week for the same reason.

But a limited quantity has changed hands in the open market during the week, as buyers state that their orders have again been reduced for heavy wasty wools, of which a great bulk of the stock held here is made up, and the orders held for the better and lighter descriptions of wool have also been reduced. Altogether, the market is exceedingly quiet at the present time, and is likely to continue so until after the Agricultural Show has been held here next week.

We quote the following as current prices:—

	d.		d.		d.		d.
Snow-white, extra superior ...	None offering			Grease, short, very wasty.......	1¾	to	5¾
„ superior...........	21	to	21½	Cross-bred grease..............	6¾	„	9
„ good to superior....	19	„	20	Cross-bred scoured.............	14	„	16
„ inferior faulty......	17	„	18	Grease, coarse and coloured.....	5½	„	6¼
Grease, super choice clips.......	10¾	„	11½	Scoured, coarse and coloured....	9	„	14
Grease, super long, well-conditioned, grassveld grown (special clips)...............	10	„	10¾	Basuto grease, short............	6¼	„	6¾
Grease, super long, grassveld grown......................	9	„	9½	O.F.S. grassveld grease, long and well-conditioned (special clips)	8¼	„	9½
Grease, super long, Karroo grown (special clips)...............	9½	„	9½	O.F.S. grassveld grease, long and well-conditioned.............	7¼	„	7¾
Grease, super long, Karroo grown	8	„	8¼	O.F.S. grassveld grease, medium grown, light, with little fault	6¼	„	6¾
Grease, super long, mixed veld..	7¼	„	7¾	O.F.S. grassveld grease, short, faulty, and wasty	5	„	5¾
Grease, light, faultless, medium, grassveld grown.............	7½	„	8¼	O.F.S. Karroo grown, long and well-conditioned.............	6¾	„	7¼
Grease, light, faultless, medium, Karroo grown...............	7¼	„	7¾	O.F.S. medium grown, light, with little fault..................	6	„	6½
Grease, light, faultless, short, Karroo grown...	6¼	„	6¼	O.F.S. short, faulty, and wasty..	4¾	„	5½

Mohair.—Arrivals continue small and consequently but little business has been done during the week. With this article, too, there is likely to be nothing done during the coming week, but the outlook is favourable to the prices at present obtainable being at least maintained.

The following are current values of

	d.		d.		d.		d.
Super summer kids..........	None offering			Seconds and grey..............	8½	to	9
Ordinary kids	18	to	20	Thirds........................	5	„	5½
Mixed kids....................	16	„	17	Winter kids, special clips (nominal)	14½	„	16
Ordinary firsts................	12½	„	13	Winter kids, good ordinary......	13½	„	14
Superfine long blue O.F.S. hair..	12½	„	13½	Winter mohair.................	9¾	„	10¾
Mixed O.F.S. mohair (average)..	10½	„	11½	Basuto mohair.................	11½	„	12½
Mixed O.F.S. mohair, very mixed	9½	„	10	Basuto mohair, grey	8	„	9

Skins.—The following are the prices we obtained for the several descriptions this week:—Sheepskins, 6⅜d. per lb.; damaged, 5½d. per lb. Pelts, 4½d. per lb.; damaged, 3d. per lb. Hair Capes, 2s. 10d. each; sundried, 1s. 11d. each; cut, 1s. each; damaged, 7d. each. Coarse wools, 6d. per lb. Goat, 13¼d. per lb.; heavy, 10d. per lb.; sundried, 10½d. per lb.; damaged, 6d. per lb. Bastards, 11d. per lb.; damaged, 4½d. per lb. Angora, 8¼d. per lb.; sundried and heavy, 7½d. per lb.; shorn, 6¼d. per lb.; damaged, 3½d. per lb. Johannesburg sheep, 5d.; damaged sheep, 2½d. Pelts, 2¼d. Goat, 10d.; damaged, 5d. Angora, 6½d.; damaged, 2d. per lb.

Hides.—Sundried, 12¼d.; damaged, 11d.; salted, 11d.; damaged, 10d. per lb.

Horns.—3½d. each all round.

EAST LONDON.

The Produce Department of Messrs. Malcomess & Co., Ltd., write as follows under date 28th March, 1913:—

Wool.—The chief item of interest to the wool trade, since last we had the pleasure of addressing you on the 27th ult., has been the second series of the London Colonial Wool

Sales, and its general effect upon the wool market in the Province. Opening on the 4th instant with the offerings of 144,000 bales Australasians and 11,000 bales Capes a strong tone prevailed. Competition was keen both from the Continental and Yorkshire sections of the trade but against this had to be set off a complete lack of orders for American account. In fact, America, rather than contemplating fresh purchases has actually been reshipping to London wools bought there in previous sales. However, opening prices ruled as follows :—

> Combing grease.......................... Unchanged.
> Snow-whites.............................. Par to 5 per cent. higher.
> Heavy combings—Par to 5 per cent. lower, due to readjustment of yields not to an actual decline in values.

The further progress of the sales was reported as follows :—

> "London sales progressing weaker. Buyers refuse to go on except at lower prices. Cause of declining market is monetary stringency and delay in combing consequent upon heavy arrivals."

The series finally closed at the decline, without any special change in prices, with the following quantities held over :—24,000 bales Australians and 2000 bales Capes.

The chief cause for the weakening of the market may be sought in quarter in which we have all along predicted it would be found, namely—bad yield results.

Underyields of from 2 to 6 per cent. are talked about in all three shipping ports, Durban and Algoa Bay being every bit as hard hit as East London. Naturally these terrible results have made buyers very cautious and they have had to completely alter their ideas of estimates—consequently the lower prices are really an adjustment of yields rather than a market decline.

There can be no doubt, however, that the end of the month does see a slightly weaker tendency. The metal market is generally the barometer of the wool market, and iron, copper, tin, have all dropped lately. Wool has been on a very high basis lately, and Bradford Tops which stood at 29¼d. three weeks ago are now 29d., while values on the Continent are also a per cent. or so lower. Possibly it is only temporary, but it is a very sure sign that the wool trade is alive to the dangerous level of prices, and wants to prevent values—already unduly high—from running away at the beginning of the new season.

The local market is very quiet. There is still a fair stock of old season's heavy long wools, but the weakness of this class in London and the very heavy losses sustained through underyields causes them to be left absolutely on one side by the buyers. New season's wools, when available and of good condition and length, are eagerly snapped up. Some of the Transkeis coming to hand are very clean and light and big prices will be made if the wools are packed dry, and the bales do not contain short snuffy stuff. We had 8¼d. offered for a very nice lot and sold an average lot at 8d.

Up-country shorts are few and far between as yet.

We quote as follows :—

	d.	d.
N. S. Transkeis, best clean dry light parcels................	8 to	8½
N. S. Transkeis, average parcels.	7¼ „	8
N. S. Basutos, good to average ..	6½ „	7¼
Super short Kaffrarian farmers', purely nominal	8 „	10
Super long Kaffrarian farmers', purely nominal	8 „	11½
Super short well-conditioned grassveld	6 „	8½
Super long well-conditioned grassveld	6½ to	9¼
Short faulty grease.............	4½ „	6
Long „ „	5¼ „	7½
C. and C. grease (good average)..	5½ „	6½
„ „ (very kempy to inferior)	3 „	5

The month's transactions are as follows :—

Week ending		Bales.	Bales.		
Week ending	1st,	2900 offered,	1000 sold.	Sales for week,	2000 bales
„ „	8th,	2000 „	800 „	„ „	3000 „
„ „	15th,	2000 „	850 „	„ „	2000 „
„ „	20th,	1400 „	400 „	„ „	1000 „
„ „	28th,	— no sale	- „	„ „	500 „
		8300	3050	Total ...	8500

Leaving stocks about 6000 bales.

Mohair.—There is nothing of note to report under this heading, and we amend our quotations as follows :—

	d. d.
Best sorted silky full 12 months grown, blue, free from kemp (nominal)	11½ to 12½
Good long blue, silky, full 12 months grown, slightly kempy (nominal)	11 to 12

	d.		d.
Good to best sorted Basuto hair	11	to	11¾
Average Basuto hair	9	„	11
Sortings according to quality and length	5½	„	7½

	d.		d.
Coloured hair, up to	6½		
Super short summer hair, up to	11		
Super long summer hair, up to	12		
Super summer kids	16	to	18
Average summer kids	14	„	16

Sundry Produce.—All the lines under this heading have shown decided weakness during the month under review. In the *Sheepskin* sales most classes were somewhat weak with an occasional deline, though the ultimate prospects are uncertain. The weakness in the *Hides* market continues and the Hide sale in London show ¼d. decline in S. D. generally, ½d. decline in D. S. extra heavy hides, ⅜d. decline in D. S. generally, and local quotations are now ½d. to ¾d. below values ruling end of last month. *Goat* and *Angora skins* shared in the general weakness and stand at 1d. to 1½d. below last month's rates. We quote: Sundried hides, 11¼d. to 11½d.; dry-salted hides, 10¼d.; goatskins, 12¼d.; bastards, 10d.; angoras, 8d. to 8½d.; damages, 5d. each. Sheepskins: First quality parcels, 6¾d.; C. and C. skins, 5d to 5¼d.; C. and C. skins, including capes, 5¾d.; pelts, 4½d.; Transkeis, 4¾d. Horns, according to size and quality, 2d. to 3d. each.

DURBAN.

Messrs. Reid & Acutt's Wool Mart, Ltd., Esplanade, Durban, report as follows under date 1st April, 1913:—

Wool. The month of March has been rather a quiet one in the local wool trade, as supplies of long woo's have been very small, and short and lambs' wools have not yet arrived in any quantity.

The London March sales which opened there on the fourth of that month closed on 19th idem., when we received the following cablegram from our London friends, viz.:—

"The sales have closed compared with the closing rates of the last series:—

Grease combing, light	Par.
„ heavy	5 per cent. lower.
Grease clothing, light	2½ per cent. higher.
„ heavy	Par.
Snow-whites, all descriptions	5 per cent. higher."

Locally these changes have been fully reflected, as the few lots of heavy combing wools which remain on hand are only now saleable at reduced prices, while short wools in light condition, and lambs' wools, are in very keen demand at excellent rates, all available parcels of these classes being eagerly competed for.

The summer clip will now be arriving in larger quantities, and we fully anticipate that to-day's excellent rates will be well maintained for all short and lambs' wools in light condition, but as quantities get larger we are inclined to think that values for short, snuffy parcels, and all heavy conditioned lots will tend to recede.

Coarse and Coloured Wool still continues in strong request.

Mohair.—The quantity offering is still small, but the market is strong, and prices have recently shown a distinct improvement.

The following are the prices current here to-day:—

NATAL AND EAST GRIQUALAND.

Midlands.

	d.		d.
Sorted clips, light and clean	10	to	12 Nominal.
Unsorted clips, light and clean	9	„	10½
Short to medium lambs	7½	„	8½
Medium to long lambs	8½	„	9½

Utrecht and Vryheid.

	d.		d.
12 months' sorted clips, light and clean	8½	to	9¼
12 months' average clips, light and clean	7¼	„	7¾
6 to 9 months average	6½	„	7¼
Short to medium lambs	6½	„	8
Medium to long lambs	7½	„	8½

Ladysmith, Newcastle, Dundee, etc.

	d.		d.
12 months' sorted clips, light and clean	9	to	10
12 months' average clips, light and clean	7½	„	8½
6 to 9 months average	6¼	„	7
Short to medium lambs	7	„	8
Medium to long lambs	8	„	9

East Griqualand.

	d.		d.
12 months' sorted clips, light and clean	8¾	to	9¼
12 months' average clips, light and clean	7¼	„	7¾
6 to 9 months light and clean	6¼	„	7
Short to medium lambs	6½	„	7½
Medium to long lambs	7½	„	8¼

TRANSVAAL.

Volksrust, Wakkerstroom, Ermelo, Amersfoort, etc.	d.		d.
12 months' sorted clips, light and clean	9	to	10
12 months' average clips, light and clean	7¾	„	8¾
6 to 9 months average	6½	„	7¼
Short to medium lambs	6½	„	8
Medium to long lambs	7½	„	8½

Standerton, Bethal, Middelburg, etc.	d.		d.
12 months' sorted clips, light and clean	8	to	9
12 months' average clips, light and clean	7	„	7¼
6 to 9 months average	6	to	6¾
Short to medium lambs	6¼	„	7½
Medium to long lambs	7¼	„	8

Heidelberg, Pretoria, Potchefstroom, Klerksdorp, Lichtenburg, etc.	d.		d.
12 months' sorted clips, light and clean	7½	to	8¼
12 months' average clips, light and clean	6½	„	7¼
6 to 9 months average	6	„	6¾
Short to medium lambs	5¾	„	7
Medium to long lambs	6¾	„	7½

ORANGE FREE STATE.

Harrismith. Vrede, Bethlehem, Heilbron, etc.	d.		d.
12 months' sorted clips, light and clean	8	to	9¼
12 months' average clips, light and clean	7¼	„	8
6 to 9 months average	6¼	„	7¼
Short to medium lambs	6½	„	7½
Medium to long lambs	7½	„	8½

Lindley, Kroonstad, Vredefort, Parys, etc.	d.		d.
12 months' sorted clips, light and clean	7¾	to	8¾
12 months' average clips, light and clean	7	„	7½
6 to 9 months average	6	„	6¾
Short to medium lambs	6½	„	7½
Medium to long lambs	7½	„	8

Senekal, Ficksburg, Ladybrand, Winburg, etc.	d.		d.
12 months' sorted clips, light and clean	7¾	to	8½
12 months' average clips, light and clean	6¾	„	7¼
6 to 9 months average	5¾	„	6½
Short to medium lambs	6¼	„	7¼
Medium to long lambs	7	„	8

Coarse and Coloured.	d.		d.
Free from kemps	5½	to	6¼
Ordinary	4	„	5
Inferior, kempy, and Persian	2	„	3½

BASUTOLAND AND NATIVE WOOLS.

	d.		d.
Superior lots, light and clean	6¼	to	7
Average lots, light and clean	5½	„	6¼
Average lots, heavy and wasty	5	„	5½
Transkei, good	7	to	8
Transkei, ordinary	6	„	7

MOHAIR.

	d.		d.
Kids, good length and super quality	12	to	15
Long blue, super quality	10½	„	12
Long blue, average	9½	„	10½
Good winter	8¼	to	9¼
Short and mixed winter	7½	„	8¼
Inferior and coloured	3	„	6

BASUTOLAND AND NATIVE MOHAIR.

	d.		d.
Good length and quality	10	to	11
Average lots	8½	„	9½
Inferior and short mixed	6	to	8

HIDES, SKINS, HORNS, ETC.

All descriptions are in good demand.

Hides.—Sundried, 14 to 20 lb. average, 10½d. to 12½d. per lb.; sundried, inferior, 8d. to 9d.; salted, 9d. to 10d.

Sheepskins.—Long-woolled, 5½d. to 6¼d. per lb., short-woolled, 3½d. to 4½d; pelts, 1½d. to 3d.; coarse and coloured, 3d. to 5d.; salted, heavy, 4d. to 5¼d.

Goatskins.—Mixed parcels, sound, 4d. to 6½d. per lb.; inferior, 2d. to 3d.

Horns.—3d. to 12d. per pair.

Wattle Bark.—Cut and bagged, good colour and quality, 4s. 6d. to 5s. per cwt.; cut and bagged, inferior colour and quality, 3s. 6d. to 4s 6d. per cwt.: uncut in bundles, good colour and quality, 3s. to 4s. per cwt.; uncut in bundles, inferior, 2s. to 3s. per cwt.

Importation of Live Stock.

RETURN showing particulars of certain Pure-Bred Live Stock imported into the Union of South Africa.

Stud-Book No. or Name.	Breed and Stud-Book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
HORSES:				
Not stated	Thoro'bred. English Stud-book. vol. 22	Colt (entire)	England	James D. Morgan, Vichy Villa, Queenstown.
" "	" "	Stallion	"	H. A McCallum (26.2 13).
" "	" "	"	"	" "
"Meltonite" ...	Thoro'bred.—English Stud-book, vol. 21	Colt	"	John Henderson, 32 Essenwood Rd., Durban (14.3.13).
Not stated	Thoro'bred.—English Stud-book (vol. not stated)	"	"	Harry Young, Wynburg, C.P.
" "	" "	"	U.K.	" "
" "	" "	Mare	"	R Brendon, c/o S.A. Turf Club, Capetown.
" "	" "	"	"	" "
17992	Hackney. Hackney Stud-book	"	England	E. H. Mellish, Vredehoek, Buitenkant St., Capetown (21.2.13).
22908	" "	"	"	" "
20962	Hackney. Hackney Stud-book, vol. 25	Stallion	"	John Ferguson, Dundee, Natal (13.3.13).
—	Hackney	"	Argentina	J. Piccione, Greenfield, Mooi River, Natal (9.3.13).
—	"	"	"	" "
—	"	"	"	" "
—	"	"	"	" "
—	"	Mare	"	" "
—	"	"	"	" "
32	Suffolk Punch. Argentine Sfflk. Punch Stud-book	Stallion	"	" "
44	" "	"	"	" "
63	" "	"	"	" "
64	" "	"	"	" "
CATTLE:				
Pedigree Cert. No. 159	Ayrshire. Ayrshire Cattle Herd Society	Bull	Gt. Britain	King, Werner & Co., Kalomo, N.W. Rhodesia.
" " 165	" "	"	"	" "
"Lawside Tightener." No. 9275	" "	"	"	F. A. Breetzke, Queenstown (14.3.13).
Not stated	Not stated	Heifer	"	F. Henderson, Lake Chrissie, Tvl. (7.3.13)

Stud-Book No. or Name.	Breed and Stud-Book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
CATTLE—(*contd.*):				
"Barney 3rd," No. 9759	South Devon.—South Devon Herd-book, vol. 12, p. 169	Heifer	Gt. Britain	D. McCall, Zeerust (7.3.13).
"Curly 6th," No. 9764	" "	"	"	" "
"Handsome 9th," No. 9765	" "	"	"	" "
"Ruby," No. 9769 ...	South Devon.—South Devon Herd-book, vol. 12, p. 170	"	"	" "
"Leigham Duke" ...	South Devon ...	Bull calf	"	" "
PIGS:				
"Cornwood Baron," No. 3815	Large Black.—Large Black Pig Society's Stud-book, vol. 14	Boar	"	Alfred Barlow, Wolvehoek, O.F.S. (17.2.13)
"Drayton Chinella," No. 9754	Large Black.—Large Black Pig Society's Stud-book, vol. 13	Sow	"	" "
Not stated	Not stated	Boar	"	F. Henderson, Lake Chrissie, Tvl. (7.3.13).

Agricultural Show Dates, 1913.

Secretaries of Societies which propose holding shows during 1913, the dates of which do not appear in the following list, are invited to send particulars at the earliest opportunity.

TRANSVAAL.

Potchefstroom, 23rd and 24th April.
Heidelberg, 23rd and 24th April.
Pretoria, 22nd to 24th May.
Rustenburg, 30th and 31st May.
Waterberg, 28th May.
Wolmaransstad, 4th and 5th June.
Pietersburg, 11th and 12th June.
Barberton, 4th July.
Klerksdorp.—No show owing to drought.

NATAL.

Vryheid, 6th June.
Ixopo, 19th June.
Umvoti, 20th and 21st June.
Alexandra, 24th June.
Pietermaritzburg, 25th to 27th June.
Durban, 2nd to 4th July (provisional dates).
Stanger, 9th July.
New Hanover, 10th July.
Richmond, 25th July.

Current Market Rates of Agricultural Produce and Stock.

The following TABLE OF CURRENT MARKET RATES OF AGRICULTURAL PRODUCE AND LIVE STOCK on Saturday, 29th March. 1913, ruling at the several Centres named, is published for general information.

Centre.	A. Wheat per 100 lb.	B. Wheat Flour per 100 lb.	C. Boer Meal per 100 lb.	D. Mealies per 100 lb.	E. Mealie Meal per 100 lb.	F. Barley per 100 lb.	G. Oats per 100 lb.	H. Oat-hay per 100 lb.	J. Lucerne Hay per 100 lb.	K. Potatoes per 100 lb.	L. Tobacco (Boer Roll) per lb.	M. Beef per lb.	N. Mutton per lb.	O. Fresh Butter per lb.	P. Eggs per dozen.	Q. Cattle (Slaughter).	R. Sheep (Slaughter).	S. Pigs.
Cape Province:	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	s. d.	£ s. d.
Aliwal North ...	11 6	23 0	30 0	20 0	22 0	15 0	16 0	7 0	6 0	25 0	1 0	0 8	0 6	1 0	1 6	12 10 0	15 6	*2 15 0
Beaufort West ...	12 6	17 9	13 6	10 6	10 6	9 0	8 3	4 6	5 0	14 0	1 0	0 6	†0 5½	1 3	1 6	13 0 0	13 0	5 0 0
Capetown ...	8 6	—	—	—	—	8 0	6 4	4 0	6 4	10 0	‡0 5½	—	—	1 3	—	—	—	—
East London ...	9 6	18 6	30 0	7 0	14 6	5 6	6 0	5 0	6 0	15 0	1 0	0 4	0 5	1 3	2 0	15 0 0	10 0	1 0 0
Grahamstown ...	11 6	—	—	10 6	—	7 9	8 0	7 0	—	10 6	1 0½	0 5	—	1 2	2 3	—	—	0 10 0
Kimberley ...	11 0	17 0	15 6	9 3	10 0	10 0	7 6	5 0	6 0	10 0	0 5	0 6	0 5	1 2	2 6	12 0 0	13 0	4d.p.lb.
Kingwilliamstown	10 6	17 6	14 6	11 0	11 9	8 0	9 0	6 6	—	8 6	0 7	0 5	0 5	0 10	2 0	13 0 0	21 0	4d.p.lb.
Port Elizabeth ...	10 6	—	—	10 0	—	7 6	8 0	5 6	—	12 0	—	0 6	0 6	1 4	2 4	—	—	2 0 0
Queenstown ...	12 0	17 6	—	10 0	12 0	—	9 6	—	4 6	6 6	—	—	0 4½	0 10	2 0	—	—	—
Natal:																		
Durban ...	—	—	—	—	—	—	—	4 3	—	8 0	—	—	—	1 4	2 6	—	—	—
Pietermaritzburg	12 6	—	—	9 9	—	11 9	9 0	6 0	4 0	6 6	0 4	0 5	0 6½	1 3	3 2	—	—	—
Transvaal:																		
Pretoria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Johannesburg ...	12 0	—	—	9 9‖	—	7 8	8 2	6 0	6 3	7 4	—	—	—	1 1	2 1	—	—	—
Orange Free State:																		
Bloemfontein ...	12 6	—	14 0	9 0	—	—	—	6 6	4 3	10 0	—	0 9	0 6	1 0	2 0	12 7 6	17 0	—
Harrismith ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Average, £2. 10s. to £3. † Average, 5d. and 6d. ‡ Average, 3d. to 8d. ‖ White.

Outbreaks of Animal Diseases.

THE following outbreaks of scheduled infectious and contagious animal diseases have occurred in the areas specified during the month ended 31st March, 1913.

C. E. GRAY,
Principal Veterinary Surgeon (Union).

CAPE PROVINCE PROPER.

(EXCLUDING TRANSKEIAN TERRITORIES.)

DISEASE.	DISTRICT.	AREA OR NAME OF FARM.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Anthrax ...	Barkly West ...	Groot Boetsap	1	Unkn.	—	—	—	—	—	—
	" ...	Delports Hope	1	"	—	—	—	—	—	—
	" ...	Likatlong	1	"	—	—	—	—	—	—
	Komgha	Farm Lot 4xiii/23B	6	19	—	—	—	—	—	—
	"	Farm Section 19xiii/38	1	20	—	—	—	—	—	—
	"	Farm Lot 51xiii/26 and 34	1	7	—	—	—	—	—	—
	"	Farm Lot 4xiii/33	1	18	—	—	—	—	—	—
	Kuruman	Farm Lewis	7	859	—	—	—	—	—	—
	"	Gathlose Native Reserve	3	54	—	—	—	—	—	—
	Mafeking	Farm Zwartlaagte	3	150	—	—	—	—	—	—
	"	Conroy and part of Setlagoli Crown Reserve	1	5	—	—	—	—	—	—
East Coast Fever	East London ...	Farm No. 73, Ward 3	Nil	86	—	—	1	—	—	—
	" ...	Farm No. 76, Ward 3	2	138	—	—	Nil	—	—	—
	" ...	Farm No. 77, Ward 3	3	Unkn.	—	—	"	—	—	—
	" ...	Lot 8, Farm No. 20.s., Ward 7 ...	1	"	—	—	"	—	—	—
Glanders ...	Cape	Capetown	—	1	1	—	—	2 Clin.af. & destr.	—	—

Tuberculosis ...	Cape	Various	—	—	—	—	—	258	11	Nil
	Malmesbury ...	"		—	—	—	—	21	1	"
	Paarl	"	—	—	—	—	—	40	Nil	"
	Stellenbosch ...	"			—	—	—	62	1 impor. heifer	..
	Port Elizabeth ...	Sydenham	—	—	—	—	—	28	1 destr. 12 to be destroy'd	..

NATAL.

East Coast Fever	Alexandra Division .	Beneva Estate	—			—	—	—	—	—
	Alfred " .	Lydstone	1	122		—	—	—	—	—
	Babanango .. .	Uitkyk	—	—		—	—	—	—	—
	Bergville " .	Rivulette	9	407		—	—	—	—	—
	" " .	Deelspruit	14	222	—	—	—	—	—	—
	Dundee .. .	Klipspruit	—	—	—	—	—	—	—	—
	Klip River .. .	Kensington	1	3	—		—	—	—	—
	" " .	Roodepoort	23	200	—		—	—	—	—
	Underberg " .	F.P. 377 and F.P. 215	1	110	—	—	—	—	—	—
	Newcastle " .	Glen Hart	—	—	—	—	—	—	—	—
	Ngotshe " .	Breda	1	47	—	—	—	—	—	—
	Maritzburg " .	Boshoff's Road	—	—	—	—	—	—	—	—
	Polela " .	Eden	11	48	—	—	—	—	—	—
	Inanda " .	Emoyeni	1	40	—	—	—	—	—	—
	Vryheid " .	Golden Valley	2	90	—	—	—	—	—	—
Anthrax ...	Dundee " .	Bannockburn	1	160	—	—	—	—	—	—
Mange in Equines	Durban " .	Police Station at Illovo	—	2	—	—	—	—	—	—

TRANSVAAL.

East Coast Fever	Piet Retief	Blesbokspruit No. 47	—	—	—	—	—	—	—	—
	"	Bothashoop No. 200	1	89			—	—	—	—
Glanders ...	Standerton	Standerton Town	—		1	—	—	4	—	—
	Krugersdorp ...	West Krugersdorp Town	—	—	1	—	—	—		—

TRANSVAAL.—(*continued.*)

Disease.	District.	Area or Name of Farm.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Anthrax ...	Krugersdorp ...	Vogelstruisfontein No. 62	1	78	—	—	—	—	—	—
	Witwatersrand ...	Grootvlei No. 26	1	86	—	—	—	—	—	—
	Marico	Zeerust Town...	1	3	—	—	—	—	—	—
	„	Linokhana Native Stadt	3	3000	—	—	—	—	—	—
	„	Willowpark	22	150	—	—	—	—	—	—
	„	Vlakplaats No. 40	1	30	—	—	—	—	—	—
	„	Burghersdorp...	1	2500	—	—	—	—	—	—
	„	Stinkhoutboom	1	50	—	—	—	—	—	—
	„	Vaughatbult	5	50	—	—	—	—	—	—
	„	Vlakplaats	1	30	—	—	—	—	—	—
	Witwatersrand ...	Grootvlei No. 26	1	5	—	—	—	—	—	—
	Krugersdorp ...	Florida	1	9	—	—	—	—	—	—
	Witwatersrand ...	Modderfontein No. 17	1	180	—	—	—	—	—	—
	„ ...	Driefontein No. 1	3	86	—	—	—	—	—	—
	„ ...	Elsburg Township	1	35	—	—	—	—	—	—
	„ ...	Rosettenville	1	58	—	—	—	—	—	—
	Lichtenburg ...	Putfontein No. 70	1	24	—	—	—	—	—	—
	Witwatersrand ...	Rietfontein	1	51	—	—	—	—	—	—
	„ ...	Klippoortje No 2	1	48	—	—	—	—	—	—
	Pretoria	Mooifontein No. 178...	1	40	—	—	—	—	—	—
	Marico	Linokhane Native Stad	1	50	—	—	—	—	—	—
	Krugersdorp ...	Roodepoort	3	12	—	—	—	—	—	—
	„ ...	Witpoort No. 44	1	8	—	—	—	—	—	—
Epizootic Lymphangitis	Pretoria	Pretoria Town	1	—	—	—	—	—	—	—
Lungsickness ...	Waterberg	Nooitgedacht No. 1739	2	202	—	—	—	—	—	—
	„	Noodshulp No. 329	1	167	—	—	—	—	—	—
	Rustenburg... ...	Buffelsfontein No. 387	1	100	—	—	—	—	—	—
Tuberculosis ...	Pretoria	Zonderwater No. 173	—	—	—	—	—	21	10	—

ORANGE FREE STATE.

Tuberculosis ...	Harrismith	Southeyshoek	—	15	1 Pig	—	—	—	—	—
	Bloemfontein ...	Bloemfontein Abattoir	—	—	1 Pig	—	—	—	—	—

TRANSKEI.

East Coast Fever	Mount Currie ...	Usherwood	1	423	—	—	—	—	—	—
	,, ...	Spionkop	1	36	—	—	—	—	—	—
	,, ...	Sevenfontein	1	107	—	—	—	—	—	—
	,, ...	Nooitgedacht	1	167	—	—	—	—	—	—
	,, ...	Koning's Kloon	1	270	—	—	—	—	—	—
	,, ...	Summerfield	2	130	—	—	—	—	—	—
	,, ...	Mooifontein	1	70	—	—	—	—	—	—
	,, ...	Lillyfontein	1	150	—	—	—	—	—	—
	Tabankulu	Mtyolwa's Location	103	1153	—	—	—	—	—	—
	,, ...	Mlilo's Location	17	1350	—	—	—	—	—	—
	,, ...	Dweba's Location	—	—	—	—	—	—	—	—
	Tsolo	Mti Farm	—	—	—	—	—	—	—	—
	,, ...	Lonile's Location	4	401	—	—	—	—	—	—
	,, ...	Ncelana's Location	1	792	—	—	—	—	—	—
	,, ...	Magwataza's Location	1	363	—	—	—	—	—	—
	Mount Frere ...	Mkilwa's, Noki's, and Whindu's Locations	—	—	—	—	—	—	—	—
	Butterworth ...	Lots Nos. 22*a*, 55*a*, 66*a*, 77*a*, and 24	—	—	—	—	—	—	—	—
	,, ...	Neslambe	—	—	—	—	—	—	—	—
	,, ...	Lenderman's Lot	—	—	—	—	—	—	—	—
	,, ...	Faleni's Location	—	—	—	—	—	—	—	—
	Nqamakwe	Peko's Location	—	—	—	—	—	—	—	—
	Mount Ayliff ...	Mount Ayliff Commonage	—	—	—	—	—	—	—	—
	Kentani	Kentani Commonage	—	—	—	—	—	—	—	—
	Qumbu	Shawbu Locations	—	—	—	—	—	—	—	—
Anthrax ...	Butterworth ...	Luzipo's and Faleri's Locations ...	—	—	—	—	—	—	—	—
	Kentani	Selebayi's, Makapella's, and Nthlangani's Locations	—	—	—	—	—	—	—	—
	Nqamakwe	Nobanda's and Sobekwa's Location	—	—	—	—	—	—	—	—
	Umtata	Mgikzweni	2	34	—	—	—	—	—	—
Glanders ...	Port St. John ...	Port St. John Village	—	—	2	—	—	—	—	—
	Libode	Mbekedana's Location	—	—	1	—	—	—	—	—

Farm Employment.

NOTE.—***This section is open to persons desiring to obtain employment on the land, and to farmers who require farm assistants. Notices are inserted in several succeeding issues; and advertisers are requested to advise the Editor as soon as their requirements are filled in order that their notices may be deleted.***

SITUATIONS WANTED.

A healthy, steady young man of 22 years of age, unmarried, desires situation on a farm. Born in South Africa. Thoroughly acquainted with general farming business. Not afraid to do work of any kind on a farm.—H. R. WATKINS, Smalpoort, P.O. Ida, Elliot, C.P. [1]

Applicant, 21 years of age, with knowledge of simple book-keeping, desires employment on a farm. No experience of South African farming, but is willing to learn.—ALEXANDER SIDDENS, P.O. Box 691, Capetown. [1]

Employment on farm is sought by a young German, 26 years of age. Married (but wife would not accompany him on farm). Has had good experience of farming, and horse and cattle breeding. Three years on intensive farms in Germany as manager, and can show good testimonials. Good education. Speaks English and Dutch.—FRITZ BAUM, Friederichsruh, P.O. Ida, via Indwe, C.P. [1]

Applicant, age 29, single, steady, desires to obtain situation on farm anywhere in the Union of South Africa. Accustomed to working with horses and oxen; understands all kinds of farming—agricultural and stock—and all up-to-date dairy work, calf rearing and feeding. Has had nine years' experience in South Africa.—H. H. WILLEY, South Coast Junction, Durban, Natal. [1]

Applicant, age 28, single, with some experience of agriculture, desires situation for purpose of gaining experience of general farming (crops and live stock). Speaks English, Dutch, and Kaffir.—W. M. BAKER, 230 Visagie Street, Pretoria. [2]

Opportunity for European lad, about 17 or 18 years of age, to learn farming, with special reference to tobacco, lucerne, ostrich, sheep and cattle farming, dairy farming.—J. C. RAUBENHEIMER, Seymour, C.P. [2]

Advertiser, with Free State and Rhodesian experience, desires post as manager, on salary or share basis. Preferably would like to meet man with capital and farm, who would go in for trees and side lines.—F. R. C. I., c/o *Agricultural Journal* Office. [2]

Situation wanted on farm as general learner by youth of eighteen, strong and willing. Would sign contract for definite period, providing that there are good prospects.—U. W., c/o *Agricultural Journal* Office. [3]

Management of farm wanted by experienced farmer; large and small stock and agriculture. Age 38. Ten years' South African experience.—M., Box 5230, Johannesburg. [3]

Applicant, 23 years of age, desires employment on farm as manager. South African born. Acquainted with general farming. Speaks Dutch and Kaffir, and English to some extent.—J. G. MAARTENS, P.O. Ida, via Indwe, C.P. [4]

Engine-driver wants job on farm: is used to shellers, thrashers, pumps, traction, etc. Fair carpenter and all-round handy-man. Single.—C. A. RYALL, c/o Mrs. Heydenrych, 384 Schoeman Street, Pretoria. [4]

Employment wanted by Colonial, age 27, as manager or assistant on a farm. Has had good experience in stock and agricultural farming in Cape Province for years; also good knowledge of butter-making. Speaks both English and Dutch. Good references.—G. H., Box 18, New Clare, Johannesburg. [4]

Young man, with several years' experience both in stock and agricultural farming, desires situation as farm manager. Testimonials.—P. S. CAMPBELL, Fort Beaufort. [3]

SITUATIONS VACANT.

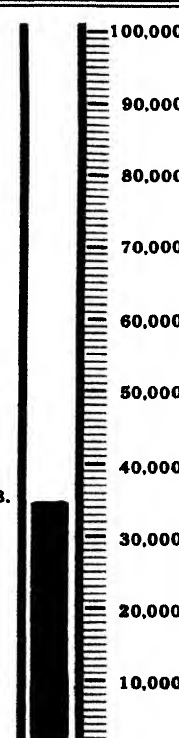
Farm assistant required—sound health, and willing and accustomed to do farm work. £2 to £3 a month, free board and lodging, according to applicant's experience and capability. Farming consists of sheep raising and lucerne growing. Applicant must engage for fixed term.—F. W. KOCK, Richmond, C.P. [4]

Opportunity for person with knowledge of gardening who would be prepared to cultivate, on his own account, portion of a farm in the Boshoff District of the O.F.S. Plentiful water supply and good soil. Terms to be arranged.—W., *Agricultural Journal* Office. Pretoria. [4]

CIRCULATION GAUGE.

DO YOU READ THE
AGRICULTURAL JOURNAL?

APRIL, 1913.



IF NOT,
WHY NOT?

Departmental Notices.

TOBACCO SEED.

The Tobacco and Cotton Division will have a quantity of selected and acclimatized tobacco seed of heavy and bright types for distribution about June, 1913. All applications for seed must reach the Chief of the Tobacco and Cotton Division, P.O. Box 516, Pretoria, not later than 1st May, 1913.

This seed will be distributed pro ratio at a charge of 1s. per oz. Each applicant will be informed soon after the 1st May what quantity can be supplied and the seed will be dispatched so soon as the cash is remitted.

Turkish Tobacco Seed: The following varieties of Turkish seed can be obtained from the Officer in Charge of Turkish Tobacco Experiments, La Motte, Paarl, Cape Province, at the prices quoted, viz.:—

Soulook	4s. per oz.
Malcadje	4s. „
Baladovari	4s. „
Dubeck	5s. „

In every case a remittance must accompany the order for seed.

W. H. SCHERFFIUS,
Chief of Tobacco and Cotton Division.

CLEANING AND GRADING TOBACCO SEED.

The Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, are prepared to clean and grade tobacco seed sent to them by farmers free of charge.

The process separates the light from the heavy seed, and the result is that a much larger percentage of the cleaned seed will germinate.

W. H. SCHERFFIUS,
Chief of Tobacco and Cotton Division.

COTTON SEED.

Selected seed of several varieties of American Upland Cotton can be obtained from the Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, at a charge of 3d. per lb.

In every case a remittance must accompany the order for seed.

W. H. SCHERFFIUS,
Chief of Tobacco and Cotton Division.

VETERINARY RESEARCH LABORATORY, ONDERSTEPOORT.

ADMISSION OF VISITORS.

It is hereby notified for the information of the public that visitors cannot be admitted to the Veterinary Research Laboratory at Onderstepoort during working hours on weekdays unless a special permit has previously been obtained from the Secretary for Agriculture.

The most convenient time for visitors to be shown over the Laboratory is Sunday afternoon, when an officer will be specially detailed for the purpose and permits will not be required.

EXPERIMENTAL FARM, POTCHEFSTROOM.

SEEDS FOR DISPOSAL.

Wheat.—Price 12s. 6d. per 100 lb. delivered at buyers' station. This price is subject to alteration without notice.

Early and Medium Early Varieties suitable for Irrigated Land.—Wit Klein Koren; Rooi Wol Koren; Spring; Glujas Early; Eckstein; Bombay; Fourie; Australian (Early); Hawkesbury; Egyptian Red.

These seeds consist of different varieties which have been experimented upon at this Farm, and have proved valuable; the crops thereof have been specially grown for seed purposes.

Application for these seeds should be made on or before the 15th March. No orders will be booked until that date, but applications may then be closed, and the available supply distributed pro rata among the different applicants. In that case only orders which have been

then definitely placed will be considered; an inquiry which is still the subject of correspondence will not be considered a definite order. These "seeds" will not be forwarded on the c.o.d. system.

Orders must be accompanied by remittance, and cheques and money orders should be drawn in favour of the Principal, Experimental Farm, Potchefstroom, from whom any further particulars may be obtained.

H. THOMPSON,
for *Principal.*

27th January, 1913.

FOWLS FOR SALE AT GROOTVLEI EXPERIMENT STATION, ORANGE FREE STATE.

A number of cockerels and pullets of the following breeds are ready for sale from the Grootvlei Experiment Station:

White Leghorns. White and Silver Wyandottes. Plymouth Rocks.

Applications should be addressed to the Poultry Manager, Grootvlei, P.O. Bloemfontein

PIGS FOR SALE.

Large white Yorkshire and Berkshire Pigs are for sale from the Tweespruit Stud Farm, P.O. Tweespruit, and large Blacks and Berkshires from the Roodepoort Stud Farm, P.O. Dewetsdorp. Inquiries should be addressed to the Managers of the farms mentioned.

ORGANIZATION OF DEPARTMENT OF AGRICULTURE.

Administrative Office ... ... Pretoria.
Telegraph Address ... ... "Landbouw, Pretoria."

Secretary for Agriculture: F. B. Smith. Under-Secretaries for Agriculture: P. J. du Toit and A. Holm. Deputy-Accounting Officer: J. Collie. Chief Clerk: G. N. Williams. Officer in Charge of Inquiry Office, Capetown: G. W. Klerck.

VETERINARY DIVISION.

This Division endeavours to prevent the introduction of contagious diseases of live stock into the Union and to eradicate such as are already present, and to protect live stock against enzootic diseases by inoculation and other means. So far as it is able to do so without interfering with its other duties, the Division advises and assists farmers upon diseases of stock generally and endeavours to enlighten them upon veterinary hygiene and the care of live stock. For veterinary purposes the Union is divided into five areas, each in charge of Senior Veterinary Officers, who are responsible for the control of disease within these areas.

Principal Veterinary Officer: C. E. Gray. Assistant Principal Veterinary Officer: J. D. Borthwick.

Cape Province.—Senior Veterinary Officer: R. W. Dixon, Government Offices, Parliament Street, Capetown. Government Veterinary Officers: C. S. Elphick, Vryburg; E. Fern, Capetown; A. Matthews, Capetown: G. W. Freer, Uitenhage; R. I. Jones, East London; J. H. L. Lyons, East London; J. Nichol, Kingwilliamstown; W. G. Pakeman, Queenstown; and W. A. Simson, Cradock.

Transvaal.—Senior Veterinary Officer: J. M. Christy, Department of Agriculture, Pretoria. Government Veterinary Officers: R. S. Garraway, Pretoria; W. G. Evans, Volksrust; P. Conacher, Johannesburg; J. G. Bush, Krugersdorp: T. H. Dale, Potchefstroom; H. M. Webb, Zeerust; J. M. Tate, Rustenburg; J. Chalmers, Nylstroom; J. I. Edgar, Pietersburg; G. Lee, Lydenburg; G. C. Webster, Barberton; D. B. J. McCall, Ermelo; and G. May, Standerton.

Natal.—Senior Veterinary Surgeon: W. M. Power, Colonial Buildings, Pietermaritzburg. Government Veterinary Surgeons: S. H. Ewing, Eshowe; A. F. Harber, Point, Durban; S. I. Johnston, Maritzburg; F. J. Hill, Bulwer; A. Goule, Maritzburg; J. L. Webb, Mooi River; C. Tyler, Ladysmith; and F. Hutchinson, Dundee.

Orange Free State.—Senior Veterinary Surgeon: A. Grist, Government Buildings, Bloemfontein. Government Veterinary Surgeons: J. F. Joyce, Ficksburg; J. A. A. Hamilton, Kroonstad; F. M. Skues, Bethlehem; C. H. Wadlow, Smithfield; and C. T. Clemow Frankfort.

Transkeian Territories.—Senior Veterinary Officer: J. Spreull, Umtata. Government Veterinary Surgeons: A. C. Kirkpatrick, A. M. Howie, T. M. Doyle, W. A. Dykins, A. Goodall, G. T. Henerson, and J. A. Worsley.

DIVISION OF VETERINARY RESEARCH.

The duty of this Division is the investigation of diseases of live stock with a view to discovering methods of eradicating them or of protecting animals against them. It examines and reports upon pathological specimens forwarded by the Veterinary Division and farmers and prepares vaccines and sera of various kinds, and also mallein, tuberculin, and other diagnostic and preventive agents.

Opportunities are offered to post-graduate students for the carrying out of specia investigations and a great deal of educational work is performed by the Division.

The Division is in close touch with and is complementary to the Veterinary Division. Director of Veterinary Research: Dr. A. Theiler. Assistant Director of Veterinary Research: W. Robertson. Superintendent: E. Parkes. Professional Assistants: D. T. Mitchell W. H. Andrews, D. Kehoe, F. Veglia, W. Jowett, G. N. Hall, G. A. H. Bedford, A. W Shilston (Pietermaritzburg), and J. Walker (Grahamstown).

DIVISION OF SHEEP.

This office is charged with:—(*a*) Eradication of scab; (*b*) improvement of pastora ndustries; (*c*) the management of the Stud Sheep Farm at Ermelo; (*d*) the improvement of the flocks maintained on the various Experimental Farms; and (*e*) the control of the Field Cornets in the Transvaal Province.

Chief of Division: B. G. L. Enslin. Principal Sheep Inspector: A. G. Davison. Principal Sheep and Wool Expert: Charles Mallinson.

For the better carrying out of the work in connection with scab, the Union is divided into twenty-four areas in charge of Senior Sheep Inspectors; these areas are in turn divided into 297 inspection districts, each in charge of an Inspector. In addition there are ten Inspectors employed on the railway lines for the prevention of the movement of infected stock by rail. There are also five whole-time Inspectors employed on certain large commonages.

A similar organization is adopted in respect of the improvement of sheep and wool.

Orange Free State Province.—Sheep and Wool Expert: J. F. McNab, Bloemfontein. Assistant Sheep and Wool Expert: A. V. M. Suter, Bloemfontein.

Cape Province.—Sheep and Wool Expert: W. M. McKee, Queenstown. Assistant Sheep and Wool Experts: E. V. Goddefroy, Worcester; P. S. Taylor, Steynsburg.

Transvaal Province.—Western District Assistant Sheep and Wool Expert: A. M. Spies, Headquarters not yet fixed. Eastern District Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal.

Natal Province.—Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal. This area includes the East Griqualand District of the Cape Province.

Manager, Ermelo Stud Sheep Farm: A. G. Michaelian.

DIVISION OF ENTOMOLOGY.

This Division obtains and disseminates information relative to beneficial and injurious "insects." In collaboration with the Division of Plant Pathology, it administers the law relating to the introduction of plants into the Union and by the inspection of nurseries and other methods, it endeavours to control injurious "insects" present in the Union; it is also responsible for the destruction of locusts.

Chief of Division: C. P. Lounsbury. Entomologists: Claude Fuller and C. P. v. d. Merwe, Pretoria; C. W. Malley, Capetown; .... Bloemfontein; and C. B. Hardenberg, New Hanover, Natal (investigating wattle insects).

DIVISION OF BOTANY.

This Division is concerned with the investigation of the merits of indigenous plants of economic importance and of poisonous plants and noxious weeds, the identification of plants, the introduction and testing of economic plants from abroad and the improvement of farm crops by breeding.

Chief of Division: J. Burtt-Davy. Herbarium Assistant: Miss C. Stent.

DIVISION OF PLANT PATHOLOGY AND MYCOLOGY.

This Division in engaged in the investigation and control of diseases of plants, produced by fungous and physiological causes, and the study and collection of fungi of economic importance.

Chief of Division: I. Pole Evans. Professional Assistants: Miss E. M. Doidge and P. v. d. Byl.

DIVISION OF TOBACCO AND COTTON.

The object of this Division is the promotion of the tobacco and cotton industries Experiments are conducted in the breeding and growth of tobacco and cotton and in the curing, fermentation, and preparation of tobacco for the market. Approved varieties of tobacco and cotton seed are distributed amongst farmers and advice given to them personally and by correspondence and publications.

Chief of Division: W. M. Scherffius. Tobacco Warehouse Expert: T. E. Elgin. Expert for Turkish tobacco, Western Province, Cape: L. M. Stella, "La Motte," Paarl. Manager, Experiment Station, Rustenburg: H. W. Taylor. Manager, Experiment Station, Barberton: W. B. Wilson. Manager, Tzaneen Estate: E. H. F. Powell. Manager, Experiment Station, Piet Retief: R. Falgate. Manager, Cotton Experiment Station, East London: D. D. Brown.

DIVISION OF DAIRYING.

This Division deals with all matters connected with the advancement of dairying. The Division also controls the Cold Stores at Vryburg.

Superintendent of Dairying: E. O. Challis. Senior Inspector:................................ Instructors: *Cape Province.*—T. R. Carruthers, Government Offices, Parliament Street, Capetown, and C. Schmolke, Queenstown. *Orange Free State.*—W. Oosterlaak, Government Buildings, Bloemfontein. *Natal.*—..............................., Colonial Office, Pietermaritzburg. *Transvaal.*—L. J. Veenstra, Department of Agriculture, Pretoria.

DIVISION OF HORTICULTURE.

This Division advises farmers on the growing and marketing of fruit, including table grapes and raisin drying, and grades fruit for export.

Chief of Division: R. A. Davis. Horticulturist in charge of Experiment Station, Warmbaths: C. A. Simmonds. Horticulturist in charge of Experiment Station, Ermelo: R. le Sueur. Instructor in Horticulture, Cape Province: S. W. van Nickerk, Bovenvallei, Wellington.

DIVISION OF VITICULTURE.

This Division is charged with the duty of advising farmers in all matters relating to the culture of the vine (excluding table grapes and raisin-making) and the manufacture of wine and brandy, and vinegar. It conducts field investigations into the suitability of various stocks, the use of fertilizers, modes of cultivation, etc., and investigates the diseases of the vine, and conducts both cellar and laboratory experiments in the making of wine and brandy. It examines pathological specimens and furnishes reports thereon, and examines chemically and bacteriologically specimens of the products above mentioned with a view to furnishing advice thereon to farmers.

This Division also includes the Government Wine Farm, Groot Constantia, where advice can be obtained by residents in the Wynberg and Hout Bay areas.

Government Viticulturist: A. J. Perold, Œnological Station, Paarl, Cape Province. Manager, Government Wine Farm, Groot Constantia: T. L. Watermeyer.

OFFICE OF GUANO ISLANDS.

This office undertakes the conservation, collection, shipment, and sale to the public of the guano, seal skins, etc., obtained on the various islands belonging to the Union, and is charged with the administration of all matters connected therewith.

Superintendent: W. R. R. Zeederberg, 69 Strand Street, Capetown.

DIVISION OF CO-OPERATION.

This Division is engaged in promoting co-operation for the sale and purchase of agricultural products and necessities amongst farmers and in organizing and supervising co-operative societies.

Superintendent. C. H. Keet. Chief Inspector. J. Retief. Assistant Inspectors: J. T. Taylor and H. Minnaar.

DIVISION OF CHEMISTRY.

This Division investigates problems of general or special importance, and for the present undertakes the analysis of soils, manures, and foodstuffs for farmers in the Transvaal, the analysis of similar matters in the other Provinces being undertaken in the laboratories of the Department of the Interior at Capetown, Grahamstown, Maritzburg, and Bloemfontein, pending the enlargement of the chemical laboratories at the agricultural schools and experiment stations.

The analyses are conducted solely for the enlightenment of the farmers and not for legal purposes.

Chemist: H. J. Vipond. Laboratory Assistant: L. Bischoff.

DIVISION OF FENCING AND BRANDS.

This Division administers the laws relating to fencing and brands, and publishes the Brands Directory, required by the Transvaal Act.

Controller of Fencing and Registrar of Brands: W. J. Nussey.

OFFICE OF HOUSEHOLD SCIENCE.

The duties of this office are to promote the study of household science by means of lectures, demonstrations, and correspondence.

Lecturer and Instructor: Miss J. C. van Duyn.

DIVISION OF DRY-LAND FARMING.

This Division conducts experiments and disseminates information on dry-land farming. An Experiment Station is maintained at Lichtenburg, with subsidiary ones at Pretoria, Warmbaths, and Pietersburg. Experiments in dry-farming are also conducted at the agricultural schools and experiment stations, and at other centres.

Dry-land Agronomist and Manager, Experiment Station, Lichtenburg: H. S. du Toit.

DIVISION OF GRAIN INSPECTION.

This Division undertakes the grading of grain at the ports prior to export, and, if requested to do so, determines the amount of moisture present in grain intended for export.

Chief Inspector of Grain: G. F. Nussey. Government graders are stationed at the docks at Capetown, Port Elizabeth, East London, and Durban.

DIVISION OF PUBLICATIONS.

This Division edits the *Agricultural Journal* and other departmental publications.

Editor: Dr. W. Macdonald.

LIBRARY.

The object of the Library is to provide as complete a collection of agricultural literature as possible for the purpose of reference.

Librarian: P. Ribbink.

AGRICULTURAL SCHOOLS AND EXPERIMENT STATIONS.

The duties of these institutions are to provide complete courses of education extending over a period of two years and shorter courses of a technical character for persons actually engaged in farming, to instruct farmers in the area served by them on matters relating to the various phases of farming by means of personal visits, lectures, demonstrations, and correspondence. To conduct experiments, to analyse soils, manures, dairy products, etc., and to identify plants and insects and test seeds. A certain amount of pure-bred stock and of new and approved varieties of seeds are produced on the farms and disposed of to the public.

The institutions do not undertake the administration of laws relating to agriculture.

Elsenburg School of Agriculture and Experiment Station.—Station: Mulder's Vlei; distance, 1½ miles.

Sub-stations at Malmesbury and Robertson.

Principal...	Dr. A. I. Perold.
Lecturer in Veterinary Science	R. Paine.
„ Horticulture	L. Tribolet.
„ Chemistry ...	D. C. Crawford.
„ Engineering	W. H. Chandler.
„ Botany and Plant Breeding	J. H. Neethling.
„ Dairying ...	J. Gow.
„ Agriculture	F. Fowlie.
Farm Manager ...	Vacant.
Agricultural Assistant ...	C. L. R. de Wet, George.

Grootfontein School of Agriculture and Experiment Station.—Station: Middelburg, Cape Province; distance, 2 miles.

Principal...	R. W. Thornton.
Lecturer in Agriculture	G. J. Bosman.
„ Veterinary Science	J. A. Robinson.
„ Engineering	E. A. Morris.
„ Chemistry ...	W. R. S. Ladell.
„ Zoology and Entomology...	R. O. Wahl.
„ Dairying ...	J. Anderson.
„ Sheep and Goats ...	E. N. C. Warren.
„ Poultry ...	A. Little.
„ Farm Manager ...	Van der Merwe.

Agricultural Assistants: J. Meldal Johnson, Humansdorp; A. K. Hards, Cathcart; W. J. Lamont, Grootfontein; and Mr. Melle, Vryburg.

Cedara School of Agriculture and Experiment Station.—Station: Cedara, on farm; sub-station at Winklespruit.

Principal...	E. Harrison.
Lecturer in Chemistry ...	C. Williams.
„ Biology ...	J. Fisher.
„ Veterinary Science	F. J. Curless.
„ Dairying and Poultry	A. Lawrence.
„ Horticulture ...	C. R. Parsons.
Farm Manager ...	W. C. Mitchell.

The Agricultural Journal

OF THE UNION OF SOUTH AFRICA.

Vol. V. MAY, 1913. No. 5.

Issued MONTHLY in English and Dutch by the Department of Agriculture.

Communications to be addressed to the Editor, Department of Agriculture, Box 515, Pretoria.
Telegraphic Address: "Bulletin, Pretoria."

Editorial Notes.

No industry is so vital to the well-being of a nation as agriculture, and nothing is so vital to agriculture as the soil. From its treasury it has been estimated that we drew during the year 1909 more than \$8,296,000,000, and its possibilities are as yet only partially realized. There are still in this country millions of acres which have never felt the plough, while those which are now under cultivation can, by the application of scientific principles, be made to produce many times the present value of their products. How to use and not abuse this great resource is the most important problem which faces the farmer of to-day one worthy of the best efforts of our most profound and learned scientists; for upon its solution depends the future prosperity of the nation.—*Bulletin No. 85, U.S. Bureau of Soils.*

Our Progress in Farming.

The publication of Part IX of the Annexures to the General Report on the Census enables us to take stock of our farming position as it was when the returns were collected in 1911, and, in part, to ascertain our progress since 1904. Since 1911 we have made some progress in spite of the drought—indeed, it may be safely asserted that the drought of 1912 has been a most wholesome lesson for many of us. Whilst, however, its immediate unfortunate effects, and not the beneficial lessons which it has taught every thoughtful farmer, would tend to be reflected in statistics that might be gathered at the present moment, there are various directions in which we have progressed beyond the position reflected in the 1911 Census returns. Nevertheless, the seven-years' comparison which it is possible to make is instructive in a high degree. It exemplifies again the wonderful farming possibilities of South Africa, and speaks with promise of the future. Unfortunately, however, we cannot make the comparison with 1904 in regard to land under cultivation and crops produced, but even these figures are interesting, as we shall see later.

Turning, then, to live stock, we find that the number of cattle in the Union increased from 1904 to 1911 by 65.61 per cent.; horses by 60.03 per cent.; asses by 137.24 per cent.; ostriches, 106.95 per cent.; woolled sheep, 84.78; other sheep, 95.80; goats, 20.39; pigs, 59.27; and poultry by 66.88 per cent. The only decrease registered was in the number of mules, which fell from 134,734 to 93,931—a drop of 30.28 per cent. This decrease was distributed over the Cape Province, the Orange Free State, and the Transvaal; in Natal, on the other hand, there was an extraordinary increase—from 4450 in 1904 to 15,602 in 1911. Natal's increase may be ascribed to the incidence of East Coast fever, which compelled farmers to substitute mules and donkeys for cattle for draught purposes; and we find this so when we turn to the number of asses returned, which was 2418 in 1904 and 28,018 in 1911—an increase of over 1058 per cent.

The number of cattle increased by 38.94 per cent. in the Cape Province; by 159.58 per cent. in the Transvaal; and by 254.14 per cent. in the Orange Free State. In Natal, as a result of the ravages of East Coast fever, they decreased by 31.61 per cent. The cattle industry, outside Natal, has therefore made wonderful progress, particularly in the Orange Free State; and pastoral progress is reflected even more noticeably in the returns for sheep. In the Cape Province we find an increase of 44.98 per cent. registered; in Natal, 127.31 per cent.; in the Transvaal, 308.68; and in the Orange Free State, 186.30 per cent. In this connection, the return showing the number of live stock of the different classes per head of the population is interesting. In the Cape Province the increase in the number per head of the population was from 0.81 to 1.06 in the case of cattle, and from 4.90 to 6.68 in the case of sheep. In Natal the number of cattle decreased from 0.60 to 0.38; sheep increased from 0.60 to 1.27. The Transvaal registers an increase of from 0.41 to 0.79 in the case of cattle, and from 0.66 to 2.03 in the case of sheep. The Free State's figures are: Cattle, from 0.94 to 2.44; sheep, from 7.74 to 16.26. The last-named Province thus possesses more sheep and more cattle per head of population than any Province in the Union.

Horse-breeding has made considerable progress in all four Provinces, the increases in the numbers of animals ranging from 13.51 per cent. in Natal to 189.47 per cent. in the case of the Orange Free State. Asses increased by 76.57 per cent. in the Free State; 90.19 per cent. in the Cape; 226.34 in the Transvaal; and by 1058.73 per cent. in Natal, as we have already seen.

Ostrich farming has been making steady progress in the Cape, where an increase of 103.29 per cent. in the total number of birds is registered. In 1904 there were in the Transvaal only 14 ostriches; 5441 were returned in 1911. The Free State's numbers increased from 1323 to 9097; Natal's from 1523 to 4111. In Natal and the Cape Province, poultry farming has not made the progress we should have liked to see, the increases in the seven years being but 24.08 per cent. in the former Province and 18.22 in the latter. The total number of birds in the Cape in 1911 is returned at 4,590,022, and in Natal 1,530,175. For the Transvaal and the Orange Free State, on the other hand, noteworthy increases are recorded. The number of poultry in the Free State rose from 627,363 in 1904 to 1,694,696 in 1911—170.13 per cent.; in the Transvaal there was an increase of 377.60 per cent.—from 568,314 to 2,719,016.

Crops and Water Supply.

Turning now to the land itself, we find some interesting figures, although, as we have said, we are unfortunately unable to institute comparisons, as the returns before us simply give us the data for 1911. The total area of land under cultivation in the Union of South Africa in 1911 was 3,282,971 morgen. In addition, there were 892,929 morgen lying fallow, and 89,945,238 morgen utilized for grazing purposes.* The figures for the Provinces are as follows:—

	Under Cultivation. Morgen.	Lying Fallow Morgen.	Grazing. Morgen.
Cape of Good Hope	974,266	376,873	58,058,667
Natal...	481,807	106,972	4,293,298
Transvaal	954,825	223,094	14,297,851
Orange Free State...	872,073	185,990	13,295,422

On this cultivated land were produced (in round figures) 1,810,300 muids of wheat, 2,060,900 muids of oats, 506,202,600 lb. of oat-hay, 407,600 muids of barley, 8,827,900 bundles of green barley, 8,632,500 muids of maize, 1,547,700 muids ot kaffir corn, 202,700 muids of rye, 279,500 muids of beans and peas, 1,228,200 muids of potatoes, 637,200 muids of sweet potatoes, 16,727,100 pumpkins, 157,150 muids of onions, 818,500 muids of mangels and beets, 14,961,200 lb. of tobacco, 122,900 tons of lucerne, 20,641 tons of paspalum and other imported grasses, 43,100 muids of ground nuts, 38,300 tons ot sugar-cane for stock, 1,095,200 tons of sugar-cane for sugar, 5,010,100 lb. of buchu, 184,600 lb. of bush tea, 79,630 tons of sugar, 46,730 gallons of rum, and 5,078,600 lb. of molasses and treacle. The cereals, root crops, pulse crops, pumpkins, tobacco, lucerne, and special pasture grasses are grown fairly extensively in all Provinces. Sugar-cane is grown for fodder purposes chiefly in Natal, which produced 36,458 tons out of the total amount of the Union. Sugar, tea, buchu, and bush tea are special products, grown principally, the two former in Natal, and the other two in the Cape of Good Hope.

Some interesting data are given in regard to irrigation and water supply in the Union. We find that there were 464,102 acres of land under irrigation in 1911, of which 282,367 acres were in the Cape Province, 18,671 acres in Natal, 113,756 in the Transvaal, and 49,308 in the Orange Free State. The area of land under irrigation in the Cape increased by 40 per cent. since 1904. Of the total area irrigated in the Union in 1911, 92,954 acres were dependent upon storage dams and wells. It is interesting to note that more than 5 per cent. of the irrigated land in the Union is to be found in the Oudtshoorn District. There were 14,602 bore-holes in the Union in 1911, of which 7513 were in the Cape Province and 5646 in the Orange Free State. In addition, the existence of 16,992 wells is recorded—8584 in the Cape Province, 4135 in the Transvaal, and 3700 in the Orange Free State.

* For the information of over-sea readers it may be stated that a morgen is equivalent to 2·11654 English acres.

Our Pastoral Products.

The Union's wool production in 1911 amounted to a little over 104½ million pounds. Of this the Cape Province produced 53.3 per cent., Natal was responsible for 4.6 per cent., the Transvaal's share was 9.3 per cent., and the Orange Free State contributed 32.8 per cent. Close on 14 million pounds of mohair were produced, 87.4 per cent. coming from the Cape, 1.4 per cent. from Natal, 3.1 per cent. from the Orange Free State. Over 5 million gallons of milk were sold in 1911, and 11¼ million pounds of butter, 10 million pounds of cream, and half a million pounds of cheese were produced. The Cape Province and the Orange Free State were the largest dairy producers, accounting between them for nearly 9 million pounds of butter, 8¼ million pounds of cream, and practically all the cheese produced (515,212 lb. out of a total of 545,290 lb.). In the case of milk sold, however, the Cape and the Transvaal led.

In the production of honey the Cape Province was responsible for 100,693 lb. of the total of 108,487 lb. produced. The figures for the other Provinces are surprisingly small, ranging from 2149 lb. to 3383 lb. It is to be hoped that the efforts of the South African Bee-keepers' Association and other bodies will be responsible for large increases by the time the next Census is taken.

We cannot pause longer over these returns. We have endeavoured to give an idea of the leading features, but it is much to be regretted that it is not possible, in the case of crops, pastoral products, etc., to make a comparison with 1904 as it was possible to do with live stock. We can safely say, however, that the increases which are recorded in the case of the various classes of live stock betoken increased farming prosperity all round, and that, were a comparison possible, we should find that the country had made very material progress in all branches of farming since 1904. Nor, with the adoption of better methods, can we help progressing. South Africa has great agricultural potentialities, a fact which is patent to any one who knows anything of the country. Dry-farming is producing crops in places where, five or ten years ago, it would have been considered folly to sow; irrigation-farming is steadily extending its furrows and raising the productive capacity of land; more cereals and better cereals are being grown; more and more farmers are becoming interested in fruit-culture, and, more than that, they are becoming *modern* orchardists, alive to the possibilities of the industry in South Africa; better wool and mohair are being produced, and every month pedigree stock of all classes are being imported into the country: dairying is making rapid strides, and the opening of new creameries is coming to be regarded as a matter of course instead of, as it was not many years ago, an extraordinary incident; the value of good pasture grasses is coming to be realized by more and more farmers, and considerable areas of paspalum, teff, and other nourishing grasses have been put down during late years. In short, there are not wanting signs of progress all round: signs of a realization of the value of good farming and of the potentialities of the country.

Should Maize be Cultivated?

"Why do we cultivate corn?" asks the *Rural New York* ("corn" being the American term for maize). "Tell most farmers that it does not pay to cultivate corn except to kill weeds, and they will laugh at you"—which is quite true. Yet, as our contemporary observes, although we have all been brought up on the theory that constant shallow cultivation makes a dust mulch and conserves moisture—and this we have believed for a long time—yet how much do we really know about it? It is a daring question to ask, this: "Should maize be cultivated?" But it is one that may well be asked after a perusal of a thought-compelling bulletin on "The Weed Factor in the Cultivation of Corn," which has lately been issued by the United States Department of Agriculture. In this pamphlet Messrs. J. S. Cates and H. R. Cox discuss a striking new theory to which they have been forced—but which for the present, be it noted, they only state tentatively—by the results of a series of experiments. First, they clearly record the results of 125 experiments scattered over twenty-eight States of the American Union and covering several years. The plan followed in these tests was to take two pieces of land of equal size and plant maize in the customary way—seed, planting, and fertilizing being the same. On one piece cultivation was carried out on the most approved plan with the idea of conserving moisture, and weeds were also chopped out. On the other piece no cultivation whatever was given. The weeds and grass were cut out with a sharp hoe, stirring the soil as little as possible. And what did these experiments show? Incredible as it may seem, they showed that, on the average, there was practically no difference in yield. In some cases the cultivated fields gave more, in some less; but, on the whole, there was practically no gain through cultivation when the weeds were kept down. Yet how do these results accord with our established idea that thorough stirring of the soil by cultivation tends to preserve soil-moisture? Let the experimenters tell their story in their own words: "The reasons why uncultivated land kept free from weeds should yield practically as much corn (grain) per acre as that given the most approved modern cultivation are not clear. The results, however, point strongly to the conclusion that the principal object of cultivation is the destruction of weeds. Where the weeds are kept down by some other method, cultivation seems to be of no particular advantage. This is contrary to the accepted teaching on this point, and *the conclusion is stated only tentatively*.

Conservation of Soil Moisture.

"There have been abundant experimental results," the authors of the bulletin proceed, "to show that, when land is fallow, a soil mulch upon it tends to preserve the moisture in the soil. It appears quite possible that, when the soil is fully occupied by the roots of a growing crop, there is little possibility of moisture from the deeper layers of the soil being drawn by capillary action to the surface where it could be evaporated, for, in doing so, the moisture would have to thread its way through a maze of roots eager to absorb it. Does it

not seem that these roots would themselves play the part that a soil mulch would play if the roots were not there? If such is the case, what additional advantage would arise by having a mulch on a surface capable of absorbing the moisture that might try to pass upward to the surface? On the other hand, these roots would not interfere to any great extent with the progress of rain-water downward in the soil, for when the rainfall is great enough to saturate the surface soil there would be more moisture present than the roots could absorb. Thus, while the soil mulch is important on fallow soils, is it not possible that a soil well filled with living plant roots is not in need of a mulch for this purpose? This would at least be a plausible explanation of the results reported in this bulletin.

"It is further suggested that these results may be partly due to the fact that tillage mutilates the surface roots of the crop. Again, a fall of rain too light to moisten the soil below the depth of stirring would all be lost on the cultivated land because it would not reach the roots of the crop, while on the weeded plot there would be enough roots in the surface soil to absorb a considerable proportion of such light rainfall before it had time to evaporate."

How will the Theory Work?

This theory that the presence of roots may render the soil-mulch unnecessary is interesting; but, granting for the moment that it is correct—for it does sound probable—what attitude are we to take up in regard to young plants? Unless a soil-mulch is provided by cultivation, how are we going to conserve the moisture in the soil from the time the seed is planted until such time as the plants have developed root-systems sufficiently extensive to render cultivation unnecessary? We have in mind, particularly, districts with an annual rainfall of less than, say, twenty inches, where, if a good crop is to be secured, every drop of rain must be held in the soil for the use of the plants so far as it is humanly possible. We fear that, in such districts as these, the abandonment of cultivation would spell poor crops with a certainty.

This period of undeveloped root-systems, when cultivation is necessary for the conservation of moisture in the soil, appears to extend over fully a month at a time, that is, when the young plants need a good start in life. According to experiments conducted by King, forty-two days after planting, when the plants were 18 inches high, the roots of two hills met and passed each other in the centre between rows 42 inches apart, and had penetrated to a depth of 18 inches. The surface roots sloped gently downward toward the centre, where those nearest to the surface were some eight inches deep. Then, at the last cultivation, when the plants were nearly three feet high, the roots occupied the entire soil to a depth of two feet, with the surface roots six inches below the centre between the rows. At tassel time the roots fully occupied the upper three feet of soil in the entire field, and in the centre between the rows the surface roots were still higher, a few being scarcely five inches deep. At maturity the roots were found penetrating to a depth exceeding four feet and within four inches of the surface in the centre between the rows.

We quote these experiments to show how the root-system develops. In the later stages of growth cultivation may possibly be unnecessary, as Messrs. Cates and Cox suggest, the roots by absorbing moisture preventing evaporation. Nevertheless, under a hot South African sun the rate of evaporation from a baked surface is so rapid that it is a question whether the roots really would succeed in using all the moisture in the upper portions of the soil. Be that as it may, however, in this country, at any rate, maize-growers would certainly be unwise to drop cultivation in the early stages of the plants' growth—until, that is to say, the root-systems are sufficiently developed to counteract capillary action.

There is one other question—if this new hypothesis should be confirmed by further experimentation—namely, the question of cost. In speaking of "cultivation" throughout the stirring of the soil for the purpose of conserving moisture has been referred to. It is assumed that, if cultivation be not carried out, the weeds will be kept cut down—an operation that must always be necessary. The question then, is—would not the destruction of weeds cost as much, or nearly as much, as cultivation? There is the capital cost of the cultivator, certainly, but, on the other hand, there is the saving in time and labour, unless a cultivator be used that works on the scratching plan or the slicing principle. And seeing that cultivation is necessary in the early stages of the plants' growth, why not continue throughout with the same cultivator, especially as cultivation does not apparently *reduce* the yield?

In quoting above from the United States bulletin, we have italicised a certain passage in which the writers say that their conclusion "is stated only tentatively." This should be fully noted by readers, for a new hypothesis in agricultural science cannot be established as fact by one series of experiments, but requires the confirmation of many. At the same time they should follow the development of this theory, if it be further developed.

The Position of Market Gardening.

With the growth of towns the question of the supply of truck crops—vegetables, herbs, small fruits, and so forth—assumes increasing importance. Not only are increasing quantities required by the municipal markets, but the demand for quality improves. In a growing country like South Africa we may study this question at first hand, and as we glance from town to town we find the sources of supply varying in a most interesting manner, from the system of Indian gardening in Natal to the European truck farmers who are gradually gathering around Johannesburg and other centres. In Natal the supply of vegetables for the Maritzburg and Durban markets is principally in the hands of Indian gardeners. This section of the Union's population provides the most intensive small-holders we have. The Indian is a born gardener, for he is the product of thousands of years of agriculture in a closely populated country. He may work by the rule-of-thumb, but he has had ample time to evolve and test his rules, and the result is that, in Natal, you have, taking them all round, the best vegetables that you will probably find in any town in the Union.

It is not that the European cannot grow as fine vegetables—on every agricultural show throughout the country you will find better and, in many cases, most excellent specimens grown by white farmers. The fault lies in the lack of systematic production, using the term in its broadest sense. Every Indian is a gardener; he has only to acquire a little patch of ground, in or out of a town, and he will start producing good vegetables without delay. He may sell his vegetables at the municipal market, or he and his wife may hawk them through the town themselves. The result is a constant supply of good stuff. Around those towns where the Indian is a negligible quantity, and where the inhabitants must depend upon white producers, two important factors militate against the maintenance of a steady supply of good vegetables. One is that, although excellent produce is grown, there are not enough good European market gardeners; the other is that the vegetables often reach the markets from distances great enough to detract from their fresh appearance.

Around the larger towns, where the demand for quality as well as quantity is greatest, there would appear to be an opening for a class of small-holders, market gardeners who would make it their business to grow good vegetables and small fruits. It is in the large towns that quality tells most, and the man who produces the freshest and finest vegetables, in the greatest variety, as long throughout the year as circumstances will permit, will surely find truck gardening a remunerative undertaking, particularly if it can be combined with dairying.

Evesham Land Tenure.

In this connection it will be instructive to glance at the system of land tenure in regard to small holdings, based on fixed rents and free sale, which prevails at Evesham. Evesham is a district in Shakespeare's county extending to 10,000 acres. The tenants are small-holders cultivating market gardens. The district began to be developed as a market garden area during the period of agricultural depression, and vacant farms were unfortunately numerous. Soil, climate, and situation are all alike favourable to this system of cultivation, out of which has grown the scheme of land tenure. The system, however, did not begin in a "cut-and-dry" fashion. Men took a few acres to cultivate "after hours," and gradually added bit by bit until they had sufficient to occupy their whole time. The people are very industrious, and, like all intensive cultivators of small holdings, have a supreme contempt for any scheme of short hours and curtailed labour. During the season they labour from early morn to dewy eve, and, having a good railway system connecting them with consuming centres everywhere, they are prosperous and happy. The crops grown are fruit trees, fruit bushes, asparagus, strawberries, herbs, etc.

Mr. Raymond Webb gave an account of how the Evesham custom works to the Farmers' Club, London, at a recent meeting. According to Mr. Webb, as reported by the *Scottish Farmer*, a tenant who wishes to realize his interest in a market garden finds his incoming tenant. The landlord retains the right to veto the tenant, but otherwise does not interfere. The question of compensation to be paid to

the outgoing by the incoming tenant is a matter of bargaining between them alone, and the landlord does not concern himself with it. The tenant has security of tenure and a fixed rent, not because any Court has settled it, but because all parties have made the discovery on economic grounds that this is a good arrangement which works out for their mutual benefit.

A typical instance of how the Evesham custom works was described by Mr. Webb. A labourer rented three acres of land at 30s. an acre, and planted it with asparagus. He held it for three years, and during that period spent about £30 in artificial manures. Owing to ill-health he resolved to give it up, and realized his tenant right at £105 cash down. He found a tenant who was willing to pay the money and enter at once. The landlord accepted that tenant, who expects to realize his £105 from the first crop of asparagus which his predecessor had planted. The services of the professional valuer are rarely required, and in practice the system is found to work admirably. A great advantage of the system is that the tenant has full inducement to keep the land in a high state of cultivation, and he can realize at any time of the year. The moral of the whole thing is that small holdings are an ideal arrangement when soil, climate, and situation are favourable for market gardening purposes.

Farming Contests in Manitoba.

An excellent feature of the activities of the Provincial Department of Agriculture of Manitoba is the periodical "Good-Farming Competition" which has been instituted. According to the *Canadian Thresherman and Farmer*, the interest in these friendly contests has been growing rapidly throughout the province, and already a great deal of good has been accomplished. During the summer of 1911, the latest year for which complete returns are available, the interest manifested was greater than in any previous year. The liberal supplementary prizes offered by the railways helped to accelerate the popularity of the contests not a little. These good-farming competitions are conducted through the various agricultural societies, the cash prizes generally being provided by them, the Department of Agriculture allowing an increased grant to such of the societies as conduct the competitions.

The judging of the farms is usually left to the staff of the Agricultural College, assisted by a few prominent and successful farmers. The judging is based upon a score-card prepared by the Field Department of the Agricultural College. The total number of points possible is 1000, perfect scores being allotted as follows:—

	Points.
General appearance	50
Cultivation—including tillage in general system of crop rotation, condition of summer fallow...	200
Farm crops—condition, purity, variety	350
Live stock—breeding, variety, comparative numbers, feeding, care, and management	150
Machinery—condition, care, management, suitability, provision for repairs, harness, and other equipment... ...	100
Farmstead—house and surrounding, out-buildings, yards, gardens, water supply, wind-breaks, hedges, etc. ...	150

Under "general appearance" is included the impression which the farm creates on approach and a general plan of the property. The methods employed in ploughing, harrowing, soil-packing, etc., are considered under the head "cultivation," as well as the system of crop rotation and summer fallow. Close attention is paid to the latter two phases, especially the presence or absence of a good system of rotation. In examining the condition of crop under the heading "farm crops," special attention is given to vigour of growth, freedom from weeds, other kinds of grain that may have got mixed in, and the extent to which the crops are true to their variety. Noxious weeds are carefully looked for, and the seed selection from year to year is inquired into. The necessity of a sufficient supply of live stock is another point which is not overlooked, as the continued fertility of the land hinges upon this requisite.

Farmers as a whole are notoriously negligent of their farm machinery, and this is an item that must be included in any competition similar to the one we are studying. In the Manitoba competition, machinery must be well housed and in good condition for efficient use. The advisability of some provision being made for repair work is also emphasized, and the judges in the last competition reported that a great many farms are now equipped with small forges and repair shops.

In reaching a decision in the difficult "farmstead" section, an effort is made to avoid handicapping the man of limited means. A small, well adapted, and sufficient house and barns are given practically as high a place in the score-card as the more pretentious and expensive places. A special point, too, is made of the suitability of the buildings and the convenience of their situation in regard to water supply, drainage, and sanitary improvements. The condition of the yard is taken into consideration, the location and construction of wells, and the judicious planting or arrangement of trees and hedges as protection for buildings, stock, etc. In short, stress is laid upon the home-like and practical conditions of the farm surroundings.

A remarkable change in certain districts as a direct result of these good-farming competitions has been noted. This is especially noticeable where friendly but keen rivalry has sprung up between groups of farmers. A steady improvement in appearance has marked some of the farms, and it is a significant fact that the prizes do not by any means go every year to the same man.

Our Canadian contemporary observes: "The judges in these competitions are eminently fair in arriving at their conclusions. The better to record impressions accurately, the cards in every case are filled out on the spot as the inspection of the farm proceeds. Memory—even a good memory—is not allowed to play any part in the scoring, and the farmer has the satisfaction of knowing that his card is completed without any outside influences affecting the score to which his farm is entitled upon its merits."

American Maize Contests.

Maize contests for young people are a great institution in the United States. They have now been in existence for many years, and, according to the accounts which reach us, their popularity is

well sustained; indeed, if anything, it is on the increase. In Minnesota alone dozens of new boys' corn clubs are being organized, and many of the old clubs are increasing in membership. Conducted on practical lines, the value of these annual maize contests is greater than would appear. Their idea is not simply to teach the rising generation how to obtain large yields of good maize on a sound paying basis: they serve a wider purpose. They show the older farmers what can be done in the direction of increasing the maize yield, and how. They raise the standard of maize growing. They set the pace, and those who are growing maize for a living may follow with the knowledge which these young contestants have obtained. Let us see what there is in this idea, taking the recently concluded Minnesota contest as our guide. The contest was open to any boy or girl in the State who was less than eighteen and more than ten years of age. The contestant was asked to sign an agreement in which consent was given to the following provisions:—At least one acre of maize should be grown; all the work should be done by the contestant, save where he is too young to do the harder work; a record of all operations should be kept and sent to the extension division from time to time, and a history of the crop-growing should be written and sent in. The championship in the last contest was secured by a boy of sixteen years of age, Arthur Hoese, who obtained a record yield of 135.14 bushels. So far as is known, this is the greatest yield of maize ever secured in the north-west. The second boy was Myron F. Wallace, who grew 130.8 bushels on his acre. Of a field of 300 final contestants, there were twenty-five boys who secured over one hundred bushels of maize per acre. There were nearly fifty contestants who obtained from ninety to one hundred bushels per acre. The greater number of those remaining varied from sixty to ninety bushels. In point of yield the contest was an unqualified success. Arthur Hoese will be given a $200 scholarship in the School of Agriculture at St. Anthony Park, St. Paul, as a reward for his work. As a preliminary to the contest he attended the junior short course at the college last spring where he obtained first prize as the best maize judge. He obtained some Minnesota No. 13 seed maize of the extension division and returned home. His maize was planted under normal conditions. The land was a rich hog pasture upon which potatoes had been grown the year before. The seed-bed was well prepared; the usual number of cultivations was given to the crop, and it was hoed twice. When picked there were 135.14 bushels of well-matured maize.

An Example for South Africa.

Here, it seems to us, is an example that might usefully be followed in some degree in South Africa. The conditions are perhaps not sufficiently favourable yet to admit of the establishment of fully organized competitions under central control for the whole country, but some very useful work might be done by local bodies, such as agricultural societies. Why not, for example, organize such competitions in connection with the more important shows? In this country, at any rate, these are the very institutions to take up and develop maize contests for juniors. We already have maize contests for farmers, which have for their object the improvement of the

general standard of maize types, but there are no contests for the highest yield of grain per acre. We want, in our maize industry, not only quality, but quality combined with quantity. The effect of well-contested competitions at our agricultural shows, carried on year by year, for the best maize, must be steadily to improve the quality of our corn; but what is wanted now is an annual competition with the object of increasing our yield per acre. Some years ago such a competition was held in Natal by, we believe, the Royal Agricultural Society of that Province, and the winner (Mr. John Moon, the well-known maize grower of Manderston) secured over thirty muids to the acre. When we add that the average yield of maize throughout Natal has for some years been in the vicinity of six muids to the acre, and that the yield in ordinary farm conditions rarely exceeds about fifteen—in exceptional cases twenty—the value of such a competition is evident.

There seems no reason why such a competition should be restricted to juniors. The value of a junior competition, of course, lies in the inducement it offers to study and to careful seed selection and soil preparation, and intelligent manuring and cultivation, thus training boys to good methods at a time when the mind is plastic and most open to the reception of new ideas. But why not, as an experiment, have a competition for farmers—that is to say, open to any one above a certain age, say fifteen years? It seems to us that, with their greater experience of maize growing, our record yields would be forced up more rapidly than if the competition were restricted to juniors.

This, however, is not an important point. There is no need for uniformity—at the commencement, at any rate—for valuable results are to be obtained no matter what age limits, within reason, are prescribed. The important point is that we should establish, by annual competitions, records in maize yields. And at the same time it should be made a condition that each competitor shall furnish full details of the history of his acre plot from the time he selects the seed to the time he harvests. The histories furnished by the prize winners should then be published for the information of others. There must, of course, be a stipulation that the crop shall be produced on such a financial basis as to render the methods adopted a business proposition; and for that reason each competitor should show the cost of producing his acre of maize.

The Value of Maize Contests.

What will be the effect of this? First, we shall have record yields established, records which, if the competition be made an annual one, farmers will strive year after year to break. Secondly, it is safe to say that every farmer who enters for the competition will, even though he may not secure a prize, obtain a yield on his acre plot in excess of the average yield on the rest of his lands. He will have striven to make that acre produce the greatest quantity of grain that his knowledge and skill can force from it, and that acre will remain, until in a subsequent year he breaks his individual record, his ideal for the farm—an ideal which he may strive to reach for the whole of his maize lands. He will have ascertained, by a

practical experiment, what his farm can produce on a paying basis, and he will endeavour gradually to extend the methods on which he worked that single acre.

The value of such an annual competition as we have suggested will therefore be incalculable. Make it for juniors or seniors, or open to both. It matters little which it is. Its value as a senior competition we have just seen. If it be restricted to juniors it will be valuable to them, and their seniors may profitably extract the lessons which each individual acre plot holds for them; and, in a larger way, advantage will be taken also of the results of the prize winners themselves. America is profiting by these competitions; why should not South Africa follow suit?

A Successful South African Student.

We were much interested to receive a visit from Mr. Harry Sonnenfeld, one of the Government Agricultural scholars, who is at present studying in the United States. Mr. Sonnenfeld is now studying for his Ph.D. degree in the University of Illinois; he already holds the degrees of B.Sc. and Master of Science in Agriculture of the University of Cornell. Mr. Sonnenfeld remarked that if a student had passed the intermediate examination of the University of the Cape, and had taken the equivalent courses to those required at Cornell, it would be possible for him to obtain the Cornell degree in two and a half years, provided he was prepared to pursue university work at the summer school. We mention this fact because several young men who wish to follow an agricultural career at one of the American universities have put this question to us. The ordinary course for a B.Sc. degree in agriculture at Cornell lasts four years after matriculation. Mr. Sonnenfeld presented "Toxicity in Soils" as his thesis for the Master's degree. He states that twenty nine different plant poisons have recently been isolated from soils by the soil chemists of the National Department of Agriculture at Washington. The main causes of the accumulation of toxic substances in soils are lack of rotation, insufficient aeration, and excessive irrigation without drainage. For his doctorate in agriculture, Mr. Sonnenfeld proposes to take as his thesis "The Influence of Sunshine upon the Bacterial Flora of Soils," with special reference to dry-farming. We are sure that all dry-farmers will look with interest to the results of these investigations. Speaking of the great advancement of farming with dynamite, Mr. Sonnenfeld informed us that the Dupont Powder Company, one of the largest manufacturers of dynamite in the world, had recently offered a scholarship for three years to an agricultural student to study at Cornell in order to investigate the beneficial effects of dynamite in the soil upon soil bacteria. The use of dynamite has proved of advantage to plant growth. Mr. Sonnenfeld speaks with great enthusiasm of the University of Cornell where he says twenty-nine new buildings are in process of erection and an extra endowment of one and a half million dollars has been granted for this year. The number of students has risen from 200 to 1200 in five years. Our best wishes go with Mr. Sonnenfeld for success in his concluding studies.

The Month and the Magazines.

Wild garlic (*Allium vinale*) has for many years been a serious pest in that belt of territory which extends from Maryland to Missouri. Besides having the usual competitive action of the perennial weed, the plant is harmful in that the bulbils on the stem frequently get intermixed with wheat grain and create an objectionable flavour in the flour. As a weed with fodder crops, this plant may have an effect in causing the tainting of milk. Considerable attention has therefore been directed by the Botanical Department of the Indiana Experimental Station towards methods for eradicating this noxious weed, and the Barbados *Agricultural News* refers to the remarkable results that have been obtained by the use of orchard-heating oil as supplied by the Standard Oil Company. It was found that when the oil was distributed over the field in a fine spray by a sufficiently powerful spraying machine, practically all vegetation was killed, not only above ground but below ground as well. It destroyed bulbs of the wild garlic below ground and the bulbils at the top of the stalks. The application of the oil appeared to have no lasting effects on the soil; the new growth from seeds already present in the soil and from subsequently sown cereals possessed the usual vigour.

An excellent article on "The Place of the Disc Harrow in the New Agriculture" appears in the *Canadian Thresherman and Farmer*. "The new agriculture" is but another name for what has come to be known in this country as "dry-farming." The writer observes that not many farmers yet realize to what an extent the fate of the crop depends upon the character of the seed-bed. Plant roots follow the path of least resistance. In a shallow seed-bed the tendency of the roots is to spread out; in a deep bed they are more vigorous and their ability to penetrate is greater. "In sandy, silt and clay loams a deep seed-bed of good tilth will produce double the crop that a shallow seed-bed will." The advantages of a deep seed-bed are thus enumerated:—(1) Ample space for the growth and development of plant roots; (2) a large storeroom for plant food; (3) it ensures (except in weed land) an abundance of atmospheric oxygen; (4) it acts as a temporary reservoir for water during heavy rains, holding the water until it filters into the deeper sub-soils; if the seed-bed is shallow much water is lost by running away; (5) if the seed-bed is well pulverized, deep, and compact, capillarity is perfect; the seed-bed should be compact, but not cemented; seeds germinate very slowly, if at all, in a loose soil, but rapidly if it is compact about them.

The following useful table, prepared by Professor C. I. Lewis, of the Division of Horticulture of the Oregon Agricultural College, and showing the proper number of trees to use in planting an orchard by the three systems, rectangular, quincunx, and hexagonal, is published by the *Pacific Rural Press*:—

Distance apart.	Rectangular	Quincunx	Hexagonal
16 × 16	170	303	196
18 × 18	134	239	164
20 × 20	108	192	154
20 × 22	90	148	104
24 × 24	76	132	87
25 × 25	70	125	80
26 × 26	64	114	74

Distance apart.	Rectangular.	Quincunx.	Hexagonal.
28 x 28	56	100	64
30 x 30	48	85	55
32 x 32	43	76	49
33 x 33	40	71	46
36 x 36	34	60	39
40 x 40	27	48	32
45 x 45	22	39	25

The appearance of a new potato of note is recorded by the *North British Agriculturist*, namely, the "Arran Chief." We read that during the past few seasons this potato has been tested in different parts of Great Britain; the test in many cases being of a severe nature. It has almost without exception taken the leading place in every trial and proved itself worthy of the name "Chief." The Arran Chief is stated to be quite a distinct variety. "The tubers, which cluster closely round the plant," says our contemporary, "are numerous, of good size, nicely rounded, and have comparatively shallow eyes. Not only so, but they are of the very best quality, and make a splendid table potato. . . Mr. William Rod, Pardovia, Linlithgow, planted 5 cwt. of the seed of the variety in the spring of this year. . . . The exact area planted was 1 rood 13 poles (approximately one-third of an acre), and the crop lifted therefrom was 4 tons 13 cwt. 3 qrs., of which 2 cwt. 3 qrs.—that is, 3 per cent.—consisted of chats and diseased potatoes. This represents a total yield of over 14½ tons per acre. . . Arran Chief is not immune from disease, but very nearly so, being infinitely superior to most varieties in that respect."

The Dairy notices that New Zealand is to make a bold bid for a part of the nine millions of money which Great Britain takes into the world's market to buy eggs. The Government of New Zealand, which takes an interest in opening out channels of commerce, is now trying an experiment in the way of sending eggs to the British market. Two months ago cases containing three thousand eggs left for London and arrived in six weeks. After their sixteen thousand miles journey they arrived when there was a surplus on the market and prices were ruling low; but these found ready purchasers at 8s. per 120. They were found to be in splendid condition and could fairly rank as new-laid. They compared favourably with anything on the market, and hardly one was broken.

Insurance against damage to crops by hailstorms is the subject of a note in the *Journal* of the British Board of Agriculture. Hail insurance may now be said to be fairly general in only two counties in England, namely, Bedfordshire and Huntingdonshire, but risks in other counties are undertaken on a small scale by the companies. Five insurance companies charge a uniform premium per acre for the whole country; but a sixth company strikes out a new line, varying the premium according to the probable risk of loss, estimated from the previous history of the particular district as regards destructive hailstorms. First-class districts, for example, comprise those where no damaging hailstorms have occurred during the growing season for the past ten years. In such districts the premiums charged are 10 per cent. less than the rates charged for ordinary districts. Ordinary districts comprise those where only one damaging hailstorm has occurred during the past ten years. In those districts double the ordinary rate is charged. This company bases its premiums on the value placed on the crop by the owner, instead of charging a rate per acre.

Disinfectants and Disinfection.

By Walter Jowett, F.R.C.V.S., D.V.H., Department of Agriculture (Veterinary Division), Capetown.

The Stock Disease Regulations provide for the isolation, and, in the case of some of the more dangerous diseases, the slaughter, of animals which are the subjects of certain of the communicable diseases, following which segregation or slaughter it is prescribed that the buildings which have been occupied by such infected animals, as well as anything which may have been in contact with the latter, shall be disinfected.

The writer's experience is that it is the exception rather than the rule to find an animal owner or attendant possessed of a knowledge of disinfectants and disinfection sufficient even for ordinary practical purposes, and in an endeavour to place at the disposal of such persons a few of the more important facts relating to this subject, the following brief account has been written.

At the present day it is perhaps hardly necessary to point out that the contagious diseases above referred to—diseases such as anthrax (miltziekte), tuberculosis, glanders, swine fever, etc.—are each due to a definite micro-organism (a microbe or "germ" in popular language), and the object of disinfection is to destroy such disease-producing microbes which have been disseminated in the surroundings by infected animals, and in this way to prevent the spread of the disease to other susceptible subjects.

In dealing with the contagious diseases of animals, it is of the utmost importance that the infected subjects be rigidly isolated quite apart and separate from their neighbours; there must be no communication between the diseased and the healthy. This is necessary primarily to guard the healthy animals from the disease in question, and in the same connection to prevent the diseased subjects from distributing broadcast the disease-producing germs which they harbour in their bodies, and which in many of the communicable diseases they pass to the exterior with their infective discharges and excreta. Whether or not such isolation will be followed by slaughter of the infected animals will depend upon the nature of the disease, and also, of course, upon the regulations in force with regard to the latter.

There are two satisfactory methods of disposing of the carcasses of animals which are the subjects of one or other of the contagious diseases, namely, burial, and the radical destruction by fire.

With regard to *burial*, one has but few remarks to offer, beyond that the grave or trench should be as deep as circumstances permit—six feet if possible—and that the body of the animal should be surrounded with a layer of quicklime. The body should be buried preferably in some isolated or enclosed place over which stock do not graze—this applies especially in cases of the disease anthrax (miltziekte). A dry gravelly soil should be selected for the grave; bodies of animals, especially those which have died of anthrax, should not be buried in the rich deep loamy soil of meadows, vleis, or on the borders of streams.

If it is necessary to transport the body of the animal some distance to the grave, it should be placed on planks or bushes and conveyed on these without touching the ground, care being taken to prevent soiling of the ground with any discharges from the dead animal. The bushes or planks so used must afterwards be burned. If the carcass is transported in a cart, this, needless to say, must be thoroughly cleansed and disinfected before being again used for any other purpose.

Cremation or Incineration.—This is the ideal method of disposal of the carcasses of animals which have died from any of the contagious diseases, but in many instances it is somewhat difficult of accomplishment, especially so in a country like South Africa, in many parts of which wood or other fuel is scarce.

In the cremation of the larger animals (horse or ox) in the field, one of the following methods may be adopted:—

1. A trench should be dug in the ground as near as possible to where the dead animal is lying. This trench should be about nine or ten feet long, five feet wide, and five feet deep, and should be almost filled with wood over which a quantity of paraffin has been poured. The layers of wood should be arranged "cross fashion" to favour more rapid combustion.

The body of the dead animal is transported on to the wood pile, eviscerated, and the carcass and viscera covered with more wood, a quantity of paraffin being poured over the whole. A light should then be applied at the base.

About five hours is required for the incineration of the carcass of a large animal by this method. The process is facilitated if shoulders be dug in the walls of the trench in order to support the ends of two iron rails which bridge the trench and serve to support the weight of the carcass—the latter, of course, being surrounded both above, below, and on each side with wood, and the whole soaked with paraffin. By this last described means a better "draught" (ventilation) is obtained, this hastening the process of combustion.

Should the animal have died from anthrax (miltziekte) the carcass should be cremated in its entirety without spilling blood. (In this disease the causal organism, the bacillus anthracis, is present in the blood at death, and, apart from the danger of contaminating the ground, anthrax is readily transmissible to mankind, hence the necessity of avoiding "cutting up the carcass.")

In many instances in this country, it may be impossible or impracticable to dig a trench five feet deep. Under these circumstances an alternative measure consists in making two banks or walls of earth or stones, filling the space between them with wood, and bridging the two walls or banks with two iron rails which serve to support the weight of the carcass. The latter is placed on top of the rails and surrounded on every side with wood soaked in paraffin; in fact, the method is very similar to that above described, except that the process is here carried out entirely above ground, and no digging of the soil is required.

2. Major-General Smith (late Director-General of the Army Veterinary Service) has described an ingenious method of cremating carcasses of the larger animals in the field. This consists in digging two trenches, each seven feet long, in the form of a cross. The

trenches are about one and a half feet wide. In depth they are about eighteen inches at the centre of the cross (where, of course, the two trenches meet and cross), becoming gradually shallower as each end of the arms of the cross is approached, where the trenches reach and become level with the surface of the ground.

The soil removed from the ground in digging the trenches is deposited in each angle of the cross, forming four mounds or banks which should be bridged by means of two iron rails. The object of the trenches is, of course, to provide for sufficient "draught" (ventilation) to ensure combustion.

The fuel, with a foundation of stout pieces of timber, is placed on the two rails bridging the centre of the cross, and the carcass is placed on top of this.

The authority referred to (Major-General Smith) recommends that the dead animal be eviscerated, and its limbs removed prior to being burned, the incineration being more speedily accomplished under these conditions. Where this procedure is adopted the carcass should first be placed on the wood pile (on the rails), more wood being placed on the carcass, followed by the limbs, then another layer of wood, the stomach, intestines, and other viscera being placed on top of all.

A quantity of paraffin may then be poured over the whole and a light applied at the base. From time to time the ashes must be raked out from the trench below the two supporting bars.

It is advisable that the evisceration and dismemberment be carried out *on the wood pile*, especially is this necessary when dealing with the carcasses of animals which have died from anthrax (miltziekte); indeed, in cases of this disease it is better, as above stated, to burn the dead animal in its entirety, avoiding all spilling of blood.

Any surface soil which has been soiled with the discharges of the infected animal should be shovelled up and thrown on to the fire in order that it may be consumed with the carcass; the same applies to bedding, fodder, or litter or other material which has been used in connection with the diseased animal, and which it is necessary to destroy.

After having disposed of the infected animals, either by slaughter or segregation, the next essential is to thoroughly disinfect the stables, cowsheds, or other buildings which they have occupied, together with any buckets, halters, headstalls, or other equipment which has been used in connection with such animals, the object of this measure being, of course to eliminate the danger to other animals of contracting the disease in question from such infected buildings or equipment.

This brings us to a study of the disinfectants and the various means of utilizing them in practice.

DISINFECTANTS.

A disinfectant may be defined as any agent—physical or chemical—which is capable of bringing about the death of living micro-organisms, or, as one authority states, "their special function (i.e. the disinfectants') is to kill or arrest the development of those germs of bacteria which produce disease."

In general it may be said that damp, dark surroundings are especially favourable to the growth and development of micro-organisms, and in this connection many of the stables and cowsheds

which are brought to one's notice from time to time fulfil these conditions admirably.

Outside the animal body various agencies are at work which tend to inhibit the action of the disease-producing microbes, and amongst what we may term such "natural disinfectants," special mention should be made of light (especially sunlight) and desiccation.

Sunlight is a great destroyer of germs (microbes), but unfortunately the force of the sun's rays is variable and its disinfectant power superficial in action. Exposure to sunlight is a sound hygienic principle, and a useful *supplementary* measure in assisting the action of other more powerful disinfectants. After their disinfection, infected buildings and objects should always be exposed freely to the influence of air and sunlight.

It is somewhat difficult to separate the action of desiccation from that of sunlight. Micro-organisms require for their growth and propagation a certain amount of moisture. Continued dryness will destroy many bacteria when in the vegetative condition, though this agent alone has no effect on certain disease-producing organisms such as the bacillus tuberculosis, and on sporulating organisms such as the bacillus anthracis, tetani, and of black-quarter, the spores of such organisms being highly resistant to adverse conditions of environment generally.

Stables, cowsheds, and other buildings used for housing animals should be dry and well lighted and ventilated. Cleanliness is equally essential; in dust, dirt, and collections of filth most micro-organisms find ideal conditions for their growth and propagation.

Cleanliness and plenty of light and fresh air are therefore of the utmost importance from the hygienic standpoint; indeed, it is impossible to over-estimate the importance of these three agencies in contributing to the health and general wellbeing of animals.

So much then for the "natural disinfectants." In this paper, however, we are more especially concerned with the "artificial disinfectants," which we shall next proceed to consider.

ARTIFICIAL DISINFECTANTS.

Under this heading are included--

(*a*) the physical means of disinfection; and

(*b*) the chemical disinfectants in the form either of gases or of liquids in various forms.

Of the physical means of disinfection *heat* in some form or other is largely utilized.

Burning is an effective method of disposing of infected articles; we have already seen that this constitutes by far the most satisfactory way of disposing of the carcasses of diseased animals, and articles of little value which have been used in connection with such subjects should unhesitatingly be "consigned to the flames."

In practical disinfection heat is applied in two forms—

(*a*) As dry heat; and

(*b*) as moist heat—boiling, and applications of boiling water, and steam.

Of these two measures moist heat is by far the more effectual. *Dry heat* is not so useful or reliable as moist heat, since it lacks the

penetrating power of the latter, and, moreover, it is liable to injure most articles except glassware and metals. Further, in many instances in veterinary practice dry heat is somewhat difficult of application.

In the practical disinfection of stables, a flame from a painter's blow-lamp or a singeing lamp may be passed over the surface of buckets, earthenware tiles, and various objects and utensils which would not be damaged by this procedure. Whilst satisfactory for surface disinfection, it is necessary, for obvious reasons, that great care be exercised in carrying out this method.

Moist heat in various forms is much used for the purpose of disinfection.

Simple boiling in water is an efficacious means of destroying germs; for practical purposes it is sufficient to prolong the action of boiling for half an hour to disinfect objects which have been soiled with infective matter. The temperature and penetrating power may be increased by adding to the water washing soda or soap.

"Flushing" with boiling water is sometimes used with the object of disinfecting walls, mangers, and floors of stables. This method alone is not very satisfactory or reliable, since it is difficult to maintain the water at the boiling point, and consequently the action at the requisite temperature is not sufficiently prolonged. On the other hand, as a *preliminary* to subsequent disinfection by chemical agents, washing and cleansing with boiling water (preferably containing or conjoined with soap and washing soda) is a very desirable measure to adopt; indeed, one may go further and say that this preliminary cleansing with hot water, soap, and soda should never be neglected.

Steam.—Steam has considerable penetrating power, and applied under certain conditions constitutes a sound means of disinfection.

Steam may be used in various forms: (1) In the form of "streaming" steam or "current steam," (2) as steam under pressure, and (3) in the form of superheated steam.

With regard to jets of steam, "streaming" steam, or "current" steam, speaking generally this possesses about the same disinfecting value as boiling water used in the form of "flushing." It has the disadvantage that on liberation in the free air it (the steam) undergoes considerable cooling, and at some distance from the orifice of the tube in which it has been generated (or rather passed) the temperature of the steam may be so reduced as to be of little germicidal value. In so far as concerns practical disinfection, therefore, the use of jets of steam at ordinary atmospheric pressure and temperature constitutes but an uncertain and unreliable method of disinfection.

Steam under pressure is a rapid and sure mode of disinfection, and in this form is much used in the laboratory for the sterilization and disinfection of media or objects. For the utilization of steam in this form, however, as for superheated steam—which is also a reliable disinfecting agent—special apparatus is required, and since such apparatus is not usually accessible to the farmer or animal owner it is unnecessary to further discuss this particular mode of disinfection in this place.

SOME COMMON CHEMICAL DISINFECTANTS.

The germicidal action of a chemical disinfectant depends not only on the *nature* of the chemical agent itself, but also on the degree of concentration and on the length of time and on the temperature at which it is allowed to act; much depends, also, on the particular species of micro-organism concerned, certain micro-organisms being much more easily destroyed than are others.

Certain disinfectants are used in gaseous form—"fumigation"—whilst others can only be applied directly to the interior of a building, or to any particular object which it is desired to disinfect.

The principal GASEOUS DISINFECTANTS are chlorine, formaldehyde, and sulphur dioxide.

In the practice of "*fumigation*" the gas is generated in the interior of the compartment, room, or stable it is desired to disinfect, all doors, windows, and ventilators being tightly closed or sealed in order to prevent escape of the gas and to ensure that the latter may act on the interior for the requisite length of time.

Unfortunately, the penetrating power of a disinfectant in gaseous form is not very marked; stated differently, we may say that the germicidal power of a disinfectant in gaseous form is only superficial. Moreover, it is somewhat difficult in many instances to seal all openings in a building in such a way as to entirely prevent the escape of a gas therefrom, and consequently it is not always an easy matter to ensure that the gaseous disinfectant will be in sufficient concentration and act for the requisite length of time.

For these reasons we shall mention but briefly the commoner chemical disinfectants. This mode of disinfection (i.e. fumigation) has but a limited use in relation to the contagious diseases of the lower animals, and, furthermore, whenever disinfection is necessary, it can be much more expeditiously carried out by the application of the disinfectant in solution (preferably *hot*) direct to the walls, floors, etc., of a building, or directly to the surface of any object which it is necessary to disinfect. As one authority observes, "there is no objection to fumigating a building as part of the disinfecting programme, but by itself it must not be trusted or it will certainly fail."

Sulphur Dioxide Gas.

Of the gaseous disinfectants we will first mention *sulphur dioxide* or sulphurous anhydride, prepared by burning sulphur in free air.

This agent acts as a germicide on micro-organisms in the vegetating condition, but it has little action on spores; it is capable also of destroying animal life. Fumigation with this agent therefore constitutes a useful means of destruction of rats, flies, fleas, and various biting flies which may serve as intermediaries and propagators of disease.

It is necessary to tightly seal the building to be disinfected, and as moisture is necessary for the efficient working of sulphur dioxide, it is desirable to wet with water the walls, floors. mangers, partitions, etc., of a stable or other building when this form of disinfection is adopted.

The method of generating the gas is by burning sulphur. The best mode of procedure is to place the requisite quantity of sulphur (in powder or rolls) in small iron vessels on the floor of the building

to be disinfected. It is advantageous to moisten the sulphur with spirit (alcohol) in order to favour combustion. The vessel containing the sulphur should be placed in a larger vessel containing water for the two-fold purpose of preventing accidents by "setting fire" to adjacent objects or to the building, and to furnish additional moisture in the room by evaporation. After applying a light to the sulphur one should leave the building as quickly as possible, close the door, windows, etc., and seal all the latter, as well as any other openings which may exist in the building.

The gas should be allowed to act for twenty-four hours, after which all doors, windows, etc., should be thrown open to permit of satisfactory aeration.

About 5 lb. of sulphur may conveniently be burned for every 1000 cubic feet of space in the building to be disinfected. (The cubic capacity of space in a building is ascertained by multiplying together its length, breadth, and height.)

Disadvantages of Sulphur Dioxide Gas.

It has the disadvantage of bleaching all colours of vegetable origin and many of the aniline colours also; in so far as concerns the disinfection of buildings used for animals, these, however, are not serious defects.

As applies to practically all methods of gaseous disinfection (fumigation), sulphur dioxide exercises only a superficial action, its penetrating power being but slight.

CHLORINE GAS.

This agent is now less frequently used than formerly, mainly on account of its irritant poisonous action, which renders its use to a certain extent dangerous.

Chlorine gas may be prepared by acting on chloride of lime with sulphuric acid. For every 1000 cubic feet of air space to be disinfected it is recommended that one should use 1½ lb. of bleaching powder (chloride of lime) and 6 ounces of sulphuric acid.

Owing to the fact that chlorine is a gas of considerable density it is advantageous to place the vessels in which it is to be generated in a somewhat elevated position in the room or building to be disinfected.

The walls, floor, and fixtures should be wetted with water before starting, after which one must quickly leave the building and tightly close and seal all doors, windows, etc. The gas should be allowed to act for six to twelve hours, after which all doors, windows, and other openings in the building should be thrown open to allow of aeration.

The gas has a marked bleaching action on colours, and, as already mentioned, it is highly poisonous.

FORMALDEHYDE.

Formaldehyde may be used either in the gaseous form or in solution. A 40 per cent. solution of the gas (formaldehyde) in water is marketed under the name of "formalin" or "formol," and this agent is extensively used for its powerful disinfectant and antiseptic properties.

In addition to formalin, a concentrated formaldehyde, known as "paraform," is also sold in the form of a whitish powder or in masses; this agent is sometimes used for generating the gas (formaldehyde) for disinfecting purposes, but the solution "formalin" also answers equally satisfactorily for this purpose; moreover, the latter is somewhat more readily obtainable in various parts of this country.

In disinfecting with formaldehyde gas, as with all other gaseous disinfectants, it is necessary to close all openings in the building which is to be dealt with. There are several different methods of liberating the gas; some require the aid of artificial heat, whilst for others the use of special apparatus is needed; here, however, we shall consider but two of the methods which appear to be the most convenient and which require no special apparatus.

Spraying.—If "formalin" be simply sprayed liberally on the surface of objects to be disinfected or on the walls of stables or rooms or on sheets suspended in the latter, the gas will be slowly liberated and serve to disinfect infected materials with which it comes in contact.

By this means, however, the gas is but slowly evolved, and prolonged contact is necessary. It is recommended that not less than 10 ounces of "formalin" should be used for each 1000 cubic feet of space to be disinfected, and the stable or room must remain tightly closed for at least twenty-four hours for safety.

By the method next to be described the gas is much more speedily liberated, and this method should preferably be adopted whenever disinfection by formaldehyde gas is desired.

Liberation of the Gas by Chemical Means.

The gas is freely liberated from "formalin" by the inter-action of the last-mentioned agent and potassium permanganate. It is recommended that for every 1000 cubic feet of air space in the building to be disinfected, 20 ounces of "formalin" and 16¾ ounces of potassium permanganate crystals should be used.

Method.—Before commencing, it is advisable to spray with water the mangers and other fixtures, as well as the walls and floor of the building, and the surfaces of any objects which it is desired to disinfect, the action of this particular disinfectant being expedited by the presence of moisture and warmth.

The requisite amount of permanganate of potash is placed in dishes or in an ordinary galvanized iron stable bucket on the floor of the room, stable, or compartment to be disinfected, and the appropriate quantity of "formalin" is then poured on to the permanganate, after which one should quickly leave the building and close all doors, windows, or other openings which lead into it. The stable or room should remain tightly closed and the gas allowed to act for at least six hours.

This method can be used with safety to sterilize clothing. Where, however, the gas is required to penetrate fabrics or clothing it should be allowed to act on them for fully twelve hours, the objects to be disinfected being hung up and arranged loosely in the compartment or room in which the gas is generated.

It should be noted that, although an efficient germicide, formaldehyde is not an insecticide, and in this respect it compares unfavourably

as a gaseous disinfectant with sulphur dioxide; the last-mentioned agent, however, has a destructive and bleaching action on fabrics, whilst, as mentioned above, formaldehyde is devoid of such destructive action.

CHEMICAL SOLUTIONS.

Methods of Applying Disinfectant Solutions.—Objects to be disinfected by means of any of the chemical disinfectants in solution should, whenever possible, be *immersed* directly in the solution—this is quite practicable, of course, when dealing with blankets, grooming utensils, headstalls, etc.

Solutions of the chemical disinfectants are largely utilized in the form of direct applications to the surfaces of walls, floors, mangers, feeding troughs, partitions, and to the various fixtures of infected stables and cowsheds. When so employed, the solution may be applied by means of mops or brushes, or preferably by means of a spray pump, or a hose-pipe attached to a small force pump; by the last-mentioned means the disinfectant solution may be forced directly into all cracks and crevices with the greatest ease.

It is advisable to apply *hot* solutions of disinfectants whenever possible in preference to cold ones, as the germicidal power of practically all chemical disinfectants is greater in hot solution than in cold. Furthermore, in every instance a preliminary cleansing with soap and boiling water (the latter preferably containing a quantity of any disinfectant whose action is not interfered with by soap, such, for example, as cresol, creolin, or "Jeyes' Fluid"), or with a hot solution of washing soda or caustic soda, is *essential*; we have already had occasion to emphasize the necessity of this preliminary cleansing—its importance cannot be over-estimated.

It would be impracticable in this place to consider in detail all the chemical agents possessed of germicidal properties which may be used for the purpose of disinfecting stables, cowsheds, or other buildings used for the housing of animals; in the following pages we shall merely mention some of those more commonly employed for this purpose, and endeavour, at the same time, to point out the advantages and disadvantages of each.

The common chemical disinfectants especially deserving of consideration are—

1. Carbolic acid (pure) or phenol.
2. Crude carbolic acid, cresol, and certain of the well-known and much-advertised proprietary disinfectants, in many of which one or other of these agents form the basis.
3. Mercuric chloride, bichloride of mercury, or corrosive sublimate.
4. "Formalin" or "formol."
5. Chlorinated lime, chloride of lime, or bleaching powder.

PHENOL—PURE CARBOLIC ACID.

Absolute phenol, "No. 1 carbolic acid," and "No. 2 carbolic acid" in crystals.

Pure carbolic acid (phenol) occurs in the form of long, white, needle-like crystals, which, after exposure to moist air, may acquire a pinkish tinge. Pure carbolic acid may also be purchased in the

form of liquefied carbolic acid (B.P.), a clear liquid containing 10 per cent. of water.

Phenol, or *pure* carbolic acid, must not be confounded with *crude* carbolic acid—a yellowish, reddish, or reddish-brown liquid—which we shall consider in a separate paragraph.

For purposes of disinfection, a 5 per cent. solution of the crystals of carbolic acid should be used. As the crystals dissolve but slowly, warm water should be employed as the solvent. Where it is necessary to disinfect large surfaces, the solution should be applied by means of a spray pump. Articles of clothing and small objects which it is desired to disinfect should remain in the solution for at least an hour. A 5 per cent. solution of carbolic acid does not injure metals, wood, dyed stuffs, or clothing.

In 5 per cent. solution, phenol (pure carbolic acid) destroys all non-sporulating germs, but it has but little action on spores, and to destroy the latter several days' contact may be required.

It is perhaps hardly necessary to point out that carbolic acid is poisonous; moreover, the pure crystals of carbolic acid are somewhat expensive, and on this account this agent is not very extensively employed for the disinfection of buildings used for animals. On the other hand it is much used for surgical purposes and for the dressing of wounds.

The germicidal action of carbolic acid is increased by the presence of sodium chloride (common salt); it is advisable, therefore, to add a quantity of salt to solutions of carbolic acid when used for disinfecting purposes.

Oil and grease diminish the germicidal power of carbolic acid—the "carbolized oil" at one time so extensively employed by the attendants on animals as a dressing for wounds, etc., possesses little, if any, germicidal power.

Soap is incompatible with carbolic acid, and it has been shown that most of the "carbolic soaps" of commerce are worthless as disinfectants.

The "carbolic disinfecting powders" prepared with a lime basis are stated to be of no value—they act merely as *deodorants* without destroying to any extent bacteria. "Calvert's carbolic powders" consist of from 20 to 30 per cent. of carbolic acid incorporated with refuse from alum works, and, for the purpose for which they are usually employed, are satisfactory. The same applies to McDougall's powders. In the opinion of the writer, however, disinfectant powders have but a limited value, and obviously they can only destroy bacteria with which they actually come in contact.

Crude Carbolic Acid.

Commercial or crude carbolic acid, also sometimes described as No. 5 carbolic acid, is one of the products of coal-tar distillation, and occurs in the form of a reddish or reddish-brown liquid, having a strong, disagreeable odour, and being but slightly soluble in water. Crude carbolic acid of commerce consists largely of tar oils and cresylic acid, with little or no phenol.

The cresylic acid is a valuable disinfectant, but the oils are almost inert as regards germicidal power; moreover, they tend to prevent the solution of the cresylic acid in water when the crude carbolic acid is added to the latter with the idea of making a solution for disinfecting purposes.

One authority recommends that when crude carbolic acid is employed, the amount of cresylic acid which it contains should be known, and the disinfecting solution (or "suspension") should be made of such strength that it will contain 2 per cent. of cresylic acid.

From the foregoing it will be apparent that crude carbolic acid is a somewhat uncertain disinfecting agent, and it is better to use the article mentioned in the next paragraph for this purpose, the article there referred to being a somewhat less impure form of crude carbolic acid, and although slightly more expensive than the latter, yet is quite cheap, and being much more uniform in composition is decidedly to be preferred as a disinfectant.

CRESOL.

"Tricresol"—"Straw-coloured carbolic acid"—"No. 4 carbolic acid."

This occurs as a pale, straw-coloured liquid, and consists of about 90 to 98 per cent. of cresylic acid or cresol, the insoluble and objectionable coal-tar oils being absent, or present only in small quantity.

Cresol is not readily soluble in water, consequently in preparing solutions for disinfecting purposes warm water should be employed. Its solution may be facilitated by the addition of soaps—in fact, the combination of this agent with a solution of soap and warm water constitutes a cheap, satisfactory, and most useful disinfectant for general purposes.

For general disinfection a 2 per cent. solution of cresol should be used. In this strength cresol is superior as a disinfecting agent to a 5 per cent. solution of (pure) carbolic acid. Although much less costly than pure carbolic acid, cresol is more effectual than the latter in destroying spores of micro-organism, such as those of anthrax bacilli. The presence of albuminous substances does not interfere with the action of cresol, and in a 2 per cent. solution this agent does not act injuriously on metals or fabrics.

Commercial cresols, guaranteed to contain more than 90 per cent. of cresylic acid, are therefore cheap and efficient disinfectants, and are well suited to the disinfection of stables, cattle markets, trucks, etc. For cowsheds, dairies, and buildings in which milking is carried out or in which milk is stored the odour of these coal-tar disinfectants may be an objectionable feature, and for such buildings it would be preferable to use corrosive sublimate (under strict precautions to prevent accidental poisoning) or formalin.

A number of reliable and cheap proprietary disinfectants depend on cresol for their active principle; in addition to certain "sheep and cattle dips" prepared from derivatives of coal-tar the following may be mentioned:—

"Jeyes' Fluid," "Cresyl-Jeyes," "Cyllin," "Creolin," "Creolin-Pearson," etc., contain tar oil consisting largely of cresols, saponified with resin and alkali. Used in 1 to 2 per cent. solution, forms a cheap and efficient disinfectant, superior to carbolic acid in disinfectant properties, and is used in the same way and for the same purposes as the latter, and as a disinfectant for general purposes.

"Izal" is said to consist of an emulsion containing about 30 per cent. of tar derivatives, produced by a special process in the manufacture of coke. "Izal" constitutes a cheap and efficient disinfectant

and is used in the same proportions and for similar purposes as the agent last mentioned.

"Lysol," a solution of cresol (about 50 per cent.) in a potash soap. A clear brown liquid forming a transparent saponaceous solution with water. As a disinfectant in the strength of 2 per cent. (about six tablespoonfuls to the gallon of water) it is superior to a 5 per cent. solution of carbolic acid. A satisfactory disinfectant for surgical purposes, somewhat more costly than the previously mentioned proprietary disinfectants, and hence less frequently employed as a general disinfectant.

The proprietary disinfectants above mentioned [Jeyes' Fluid, Pearson's antiseptic ("Hycol"), and "Izal"] seem to be in general use in this country, and for this reason they have been specially referred to in this place.

There are many other proprietary disinfectants on the market, amongst which one may mention "Kerol" (said to be a coal-tar derivative), "Lusoform" (a combination of 18 to 20 per cent. formol with soap), and "Sanitas"—prepared by the oxidation of oil of turpentine by a special process—a good non-poisonous disinfectant and an agreeable deodorizer. All these are satisfactory disinfectants; they are non-corrosive and non-irritant, and their action is not interfered with by the presence of albuminoid matter in, or on, the material or objects to be disinfected. Full directions for using these disinfectants are stated on the labels of the containers in which they are marketed.

In preparing percentage solutions, if properly graduated measures are not available, it is convenient to remember that the ordinary tablespoon of the household holds about half an ounce of fluid, a wineglass about two ounces, and a tumbler about ten fluid ounces (half a pint). There are, of course, twenty fluid ounces to the pint, two pints in a quart, and four quarts in a gallon.

A 1 to 100 (1 per cent.) solution may be prepared as follows:—

Disinfectant, 1 fluid ounce (2 tablespoonfuls) to 5 pints water.
,, 2 fluid ounces (1 wineglassful) to 5 quarts water.
,, ½ pint (1 tumblerful) to 6¼ gallons water.
,, 1 quart (4 tumblerfuls) to 25 gallons water.

Ordinary stable buckets hold about three gallons, but the size varies, and it is always advisable to definitely measure their capacity.

PERCHLORIDE OF MERCURY, BICHLORIDE OF MERCURY, CORROSIVE SUBLIMATE.

Bichloride of mercury or corrosive sublimate destroys all species of microbes, even in relatively weak solution. The action of this highly efficient germicide is limited, however, in view of the facts (1) that it is a violent and dangerous poison, (2) it has a corrosive action on metals, and (3) it is liable to combine with any albuminoid matters which may be present in the material to be disinfected, forming an inert compound. For this reason corrosive sublimate is totally unsuited to the disinfection of excremental matter (fæces, dung, manure), and for the disinfection of objects which have been soiled with various infective discharges or with blood (which contain albuminoid matter).

On the other hand, buildings or objects which have been disinfected with corrosive sublimate remain free from odour, and in this respect

corrosive sublimate compares favourably with carbolic acid, cresol, the coal-tar disinfectants, and especially chloride of lime. As already pointed out, it is of advantage to use an odourless disinfectant when dealing with cowsheds or dairies or buildings in which milk is stored; indeed, for the disinfection of such buildings, as previously mentioned, the use of corrosive sublimate, which is odourless, or of formalin, which has the advantage of being relatively non-poisonous, would seem to be particularly indicated.

Corrosive sublimate occurs in the form of a white crystalline substance not readily soluble in water. It is conveniently marketed in the form of small tablets or "soloids" in which the requisite quantity of sublimate is combined with chloride of ammonia (to increase its solubility) and some added colouring matter. These tablets or "soloids" readily dissolve in cold water, and added to a definite quantity of this liquid form solutions of any desired strength.

At ordinary temperatures a 1 in 1000 solution of corrosive sublimate suffices for the destruction of all non-sporulating micro-organisms in a few minutes. In practice it is advisable to allow contact with, or immersion in, a solution of this strength for thirty minutes, thus allowing a margin for safety. For sporulating organisms such as bacilli of anthrax, tetanus, black-quarter ("sponziekte"), more prolonged contact or a more concentrated solution is needed.

1 in 500 solutions may be effectively employed. Such solutions manifest a quicker germicidal action on non-spore-bearing organisms as well as on sporulating microbes, killing the latter in an hour or so.

Solutions of corrosive sublimate should not be kept in vessels of lead, tin, copper, or other metals, since the mercury combines with these metals, by which combination not only is the metal itself injured, but the germicidal action of the solution is impaired. Solutions of corrosive sublimate should be kept, therefore, in wooden or glass containers; objects to be disinfected may be directly immersed in the solution, or when necessary to apply the latter to extensive surfaces, mops or brushes may be used.

It is sometimes recommended that solutions of corrosive sublimate should be made with water containing common salt, since the mercury salt is more readily soluble in such solutions. This practice, however, should never be countenanced, since it has been shown that the presence of common salt in a solution of corrosive sublimate markedly interferes with the germicidal action of the latter.

In view of its highly poisonous nature, corrosive sublimate must be used with the greatest care, and after allowing contact for a sufficient length of time with the surface of walls, etc., or of objects to be disinfected, it is a wise precaution to wash or flush the latter with cold water to remove the poisonous disinfectant solution, and thus to obviate all fear of accidents.

FORMALIN. "FORMOL."

A solution of formaldehyde gas in water.

The 40 per cent. solution of formaldehyde gas in water which is marketed under the name of "formalin" or "formol" may be used for most purposes for which a disinfectant is required, including the disinfection of excreta and materials containing albuminoid matter.

Applied to the surface of objects, or mixed directly with materials to be disinfected, formalin is a reliable and highly efficient disinfectant.

A 5 per cent. solution of formalin is said to be equal or superior in germicidal power to a 5 per cent. solution of pure carbolic acid (phenol).

Formaldehyde—and of course the same applies to formalin, which, as we have seen, is a solution of formaldehyde—does not injure fabrics, and its action is not interfered with by the presence of albuminous matter in the material to be disinfected, in this respect comparing favourably with certain other disinfectants, such as perchloride of mercury. Moreover, formalin is a highly efficient deodorant.

Formalin is decidedly less poisonous than some other disinfectants, and it may therefore be used for the purpose of disinfecting hay or grain without rendering the latter unsuitable for food purposes. Still, it is necessary that the disinfected hay or grain be freely exposed to the air before being used for food purposes, the object of such aeration being, of course, to allow the formaldehyde gas to evaporate.

Formalin, unfortunately, is somewhat more expensive than cresol, but like the latter it can be recommended as a sound, reliable, and highly efficient disinfectant.

CHLORINATED LIME, CHLORIDE OF LIME, BLEACHING POWDER.

This chemical body is prepared by exposing slaked lime to the action of chlorine gas, and it occurs in the form of a white friable substance giving off an unpleasant odour. On exposure to air it evolves chlorine gas, of which for disinfecting purposes it should contain 33 per cent.

Chloride of lime is an unstable body, and unless freshly prepared is somewhat uncertain in its action. Until required for use it must always be kept in hermetically sealed containers.

As a general disinfectant for cars, trucks, stables, etc., a freshly prepared solution containing 6 to 8 ounces of chloride of lime to the gallon may be used. When limewashing cars, trucks, or buildings used for housing animals it is recommendable to add to each gallon of limewash (prepared in the usual way with quicklime) about 3 or 4 ounces of chloride of lime.

When fresh, chloride of lime is a good general disinfectant and deodorant, but it is readily attacked by various kinds of organic matter, and therefore is unsuitable for dealing with sewage or other large masses of putrefying matter.

In connection with the management of animals, chloride of lime is often used for the purpose of mixing with excreta (dung manure) to disinfect and deodorize the latter, and for drains, cesspools, and stable floors, but this agent possesses no advantages over carbolic acid and formaldehyde (or "formalin") and cresol; the last mentioned, especially, has been shown to be much superior and in general more dependable and reliable than chloride of lime as a general disinfectant.

Chloride of lime should not be used in or near buildings in which milking cattle are housed, or in which milk is stored, for this fluid, as is well known, readily absorbs any odours which may be present in its vicinity, and the flavour or smell of chloride of lime in milk is, needless to say, neither necessary nor desirable.

Finally, it may be mentioned that chloride of lime has a destructive action on metals and fabrics.

ROUTINE OF DISINFECTION.

After removal or death of the infected animal or animals from a stable or other building it is imperative that the latter be thoroughly cleansed and disinfected before allowing other animals to gain access thereto. This cleansing and disinfecting process must be carried out in a methodical and thorough manner to be of any real service, otherwise, by giving a sense of false security, it is worse than useless.

First, the walls, windows, doors, ventilators, and fixtures must be brushed down to remove cobwebs, dust, and dirt; next, the plaster and limewash should be scraped off the walls. The material so removed, together with all litter, bedding, and food left in the mangers, should be collected in a heap and *burned* either inside the stable itself, or, if on account of the materials used in the construction of the building this appears dangerous, then just outside the stable door. Combustion of this material may be facilitated by pouring a little paraffin over it prior to applying a light.

Next, the mangers, fittings, and partitions require attention. These should be scrubbed with a solution of soap in hot water containing one or other of the disinfectants mentioned, preferably cresol (Jeyes' Fluid, Creolin-Pearson, etc.), and this may also be applied by means of long brushes or mops to the walls, particular attention being paid to that portion of the wall near—and especially to that in front of—the manger. In the case of very old and dirty mangers and fittings a hot solution of soda (washing soda or caustic soda) may be needed to remove grease and dirt.

After this preliminary cleansing we may proceed with the disinfection proper. In applying the disinfectant solution a spray pump may conveniently be used, the disinfectant being sprayed over the entire surface of the walls, floor, mangers, fittings—in fact, on to every part of the interior of the building. Where, however, a spray pump or hose-pipe and force pump is not available, then one must apply the disinfectant solution by means of mops or brushes. Whichever mode is adopted great care must be taken not to overlook and omit introducing the disinfectant into all corners, angles, and crevices. Hot solutions of the disinfectant (i.e. solutions made with hot or boiling water) should be used in preference to cold ones.

If a poisonous disinfectant such as corrosive sublimate be used, one may eliminate all danger (e.g. accidental poisoning of animals from licking walls, etc.) by practising a second spraying or washing of the disinfected surfaces with clean, cold water some hours after applying the disinfectant.

Finally, all doors, windows, and ventilators should be opened to allow free access of air and light, and one may then proceed to limewash the walls and, where necessary, to paint the fittings.

The limewash should be prepared with fresh unslaked lime, and to each bucketful of the limewash a half pint or so of cresol, creolin, or of Jeyes' Fluid or similar proprietary disinfectant may be added with advantage—or, if preferred, one may add 6 ounces or so of formalin to each gallon of limewash. The limewash can be applied to the walls either with brushes or by means of a spray pump.

Should the floor of the stable or building be of earth, it is advisable to dig up and remove some four or six inches or so of the surface soil, which, after removal, should be burned or mixed with quicklime, chloride of lime, or other reliable disinfectant. The earth so

removed should be replaced with fresh soil from an uncontaminated source, or, better still, and whenever possible, a new floor of concrete or other non-absorbent material should be laid. If the floor is of concrete or similar impervious material, it can, of course, be cleansed or disinfected in the manner above indicated for walls, floors, mangers, and fittings.

Pails, buckets, brushes, curry-combs, and other stable utensils which have been used in connection with infected animals may be disinfected by immersion for a few hours in a solution of cresol (or of one or other of the proprietary disinfectants consisting largely of cresol, such as Jeyes' Fluid).

Blankets and *horse-rugs* may be disinfected in a similar manner, remaining in the bath for twelve hours or longer. One authority recommends that when dealing with outbreaks of disease in instances where receptacles for such baths are not obtainable, one may make a bath of any reasonable size by digging up a portion of ground, removing the soil, and covering the bottom and sides of the depression so made with a sailcloth or wagon-cover. After testing with water to see that it is watertight, the necessary amount of disinfectant solution may be poured in. The blankets should be opened out one by one, laid in the bath, and care taken to see that there is always sufficient disinfectant present to more than cover them.

Leather work and *leather goods* should not be steamed or boiled or treated with "formalin." The best procedure in disinfecting such articles is to scrub them with soft soap and water, after which they may be immersed for some hours in a bath of cresol or "creolin."

In disinfecting harness which has been used on animals the subjects of certain parasitic diseases, such as mange ("brandziekte"), particular attention must be directed to the stuffing and lining, which it is often better to remove and burn, afterwards disinfecting the leather work in the manner above indicated, and subsequently having the saddles and collars lined and stuffed afresh.

Litter, manure, and bedding used in connection with animals which have been infected with diseases, such as anthrax ("miltziekte"), glanders, tuberculosis, black-quarter ("sponzietke"), and of parasitic diseases, such as mange, should be burned in every case. This may be carried out by collecting the material in a heap, pouring paraffin over it, and applying a light. If for any reason this is impracticable, then the manure must be most *thoroughly* disinfected and buried as deeply as possible. Manure, litter, and bedding may be disinfected by mixing with them lime (quicklime) or chloride of lime, or a disinfectant such as cresol or creolin (and in the writer's opinion the two last-mentioned disinfectants are to be preferred for this purpose). In this event the mass of bedding or manure must *contain* the requisite proportion of disinfectant—it is not sufficient merely to add a quantity of, say, 2 per cent. cresol or creolin to the mass, the latter must *contain* 2 or 3 per cent. of cresol or the correct proportion of any other appropriate disinfectant which may be used.

Cattle markets, pens, sale yards, and *auction yards,* as well as *cattle trucks and boxes,* may be disinfected in a manner similar to that described in the foregoing pages as for disinfection of stables and cowsheds. The Stock Disease Regulations of this country provide that such enclosures or buildings must be cleansed and disinfected "at the close of each day during which they have been used," and

in the case of trucks and horse-boxes, "before they are again used for carrying animals," the cleansing and disinfection of the latter being carried out as follows:—

They must be (*a*) swept and, as far as possible, scraped; (*b*) thoroughly washed and scrubbed with water; (*c*) sprayed with a disinfectant; and (*e*) finally limewashed.

The disinfectant used for this purpose should be at least equal in germicidal action to a 5 per cent. solution of pure carbolic acid (crystals). For this purpose either formalin, or an alkaline solution of cresol, would seem to be as useful and reliable as any.

DISINFECTION OF SKINS AND HIDES.

The utilization of the skins, hides, horns, or hoofs of animals the subjects of anthrax, glanders, or like virulent diseases is prohibited; it is prescribed by the Stock Disease Regulations that the entire carcasses of animals infected with these diseases must be disposed of either by cremation or burial.

Occasionally, however, one has to deal with hides, skins, and offal which one may suspect has come from a centre of infection of one or other of the contagious diseases, and in such instances the only safe procedure is to arrange for their sterilization or disinfection.

In disinfecting hides and skins the problem is to find some reliable disinfecting medium which will effectually destroy any micro-organisms which may be present, without in any way modifying or detracting from the commercial value of the disinfected objects. Obviously boiling water and steam at 100° C. are inapplicable; moreover, strong solutions of formalin are also unsuitable in view of the fact that they tend to render hides, skins, and leather work brittle and fragile.

The disinfectant employed must be in sufficient strength to be capable of destroying the spores of anthrax bacilli, which of all the disease-producing organisms likely to be present in such objects are most difficult of destruction; moreover, for the same purpose, contact with the selected disinfectant for sufficient length of time must be allowed.

In so far as concerns anthrax, it has been shown that there is less danger to be apprehended from wet salted skins than from dry hides.

Skins and hides may be disinfected by immersion for twenty-four hours or so in a bath of a 2 per cent. solution of cresol or cyllin, or in a solution of corrosive sublimate (1 in 1000). It is said that the last-mentioned agent in the strength of 1 in 1000 is capable of destroying the spores of anthrax bacilli in skins or hides in seven hours. Twelve to twenty-four hours' immersion in such bath would therefore allow an ample margin for safety.

When dealing with skins derived from suspicious sources, it has been recommended to wash the inside of such skins when flayed with a solution of half per cent. formic acid, before salting.

If it is desired to use steam in some form for the disinfection of skins and hides a temperature (of the steam) at 70° C. should not be exceeded. If the steam be medicated with formaldehyde in the proportion of 1 per cent., it is reported that spores are destroyed by this means in from four to eight minutes.

With regard to dry hides, the process devised by Seymour Jones is reported to be efficacious, effectively destroying anthrax spores without in any way affecting the hides injuriously. This consists in immersing the hides for twenty-four hours in a mixture of formic acid (1 per cent. of 90 per cent. strength) and 1 part mercuric chloride to every 5000 parts of water. On removal from this bath, the hides are drained and then transferred to a pit containing a saturated solution of common salt for about an hour, after which they are drained. For goat and sheep skins the quantity of formic acid is less.

Hoofs, horns, bones, and other animal offal which may have been derived from sources in any way suspicious should be burned or effectually sterilized, preferably by heat.

DISINFECTION OF ATTENDANTS.

When dealing with outbreaks of certain contagious diseases, such as swine fever, rinderpest, foot-and-mouth disease, etc., in which the virus may be readily carried from infected premises by attendants, or persons who have been in contact with animals suffering from the disease, it is very necessary that means should be provided for such persons to disinfect their boots, hands, and clothing before leaving the infected premises. The boots (and in the case of native attendants the feet) and hands should be washed or scrubbed with a reliable disinfectant solution, such as cresol, creolin, Lysol, or Izal. Particular attention must be paid to the sleeves of coats or other clothing worn by animal attendants or those coming in contact and handling infected animals; the portion of the garments referred to should be sponged with a solution of one or other disinfectant devoid of injurious action on fabrics and clothing, such as "Izal," "Lysol," or "Sanitas," or, if the smell be not objected to, cresol or creolin. Solutions of corrosive sublimate can, of course, also be used. As already pointed out elsewhere in the foregoing pages, this is a most efficient disinfectant, the drawbacks to its more general use being (1) its highly poisonous nature, and (2) the fact that its action is interfered with by the presence of albuminoid matter in the material or on the objects to be disinfected. For these reasons one or other of the above-mentioned disinfectants will generally be found more suitable for this purpose.

Where any considerable outbreaks of contagious diseases are in existence, the attendants on the diseased animals should be provided with overalls, which should be removed and placed in a disinfectant bath prior to the departure of such persons from the infected premises.

METHODS OF PREPARING LIMEWASH OR WHITEWASH.

In concluding the remarks on "Disinfectants and Disinfection," it may not be out of place to give brief instructions for the preparation of limewash—this agent being in very general use wherever animals are stabled. The following directions are obtained (1) from a bulletin of the Illinois (United States of America) Agricultural Station, and (2) from the *New South Wales Agricultural Gazette*, and it is hoped that they may prove of some service to those interested in the subject:—

"Take a half bushel unslaked lime of good quality, slake it with boiling water, cover during the process to keep in steam, and

add water as the process goes on. To do this the lime should be placed in a tight barrel and water enough added to partly cover the lime. Never cover the lime entirely with water, else the slaking process will go on too slowly. Soon after the water is added the lumps of lime, which are exposed to both air and water, begin to crumble, and soon the whole mass begins to steam. More water should be added, and the barrel kept covered. After the slaking process is over several pails of water should be added, and the whole thoroughly stirred. This mixture should be strained through a fine sieve before placing in the barrel to which the pump (i.e. spray pump) is attached, and, if necessary, more water may be added to secure a mixture which the nozzle will deliver well. The contents of the barrel or bucket must be kept well agitated, for the lime tends to settle upon the bottom. The spray must be fine and not allowed to play upon one place until the wash begins to run. When applied with brushes a slightly heavier wash can be used, as it is generally well rubbed down. Light coats frequently applied are better than heavy ones, as the latter are more apt to scale off. While still wet a light coat seems to have failed in its object, but when dry the whole becomes perfectly white. One bushel of lime will make 30 gallons of whitewash."

In continuation of these directions one might mention that the addition of about 5 per cent. of common salt to the limewash will tend to render the latter more adherent and less likely to scale off the walls. As stated in the foregoing pages, when it is desired to add a disinfectant to the limewash, half a pint of cresol, creolin, or Jeyes' Fluid may be mixed with each bucketful, or 6 to 8 ounces of formalin, or 4 ounces of chloride of lime may be added to each gallon of limewash before applying the latter to the walls.

2. The *New South Wales Agricultural Gazette* (November, 1911) contains the following directions for preparing "a useful limewash which may be used on rough timber, brick work, or corrugated iron":

"Take 10 lb. of fresh unslaked lime, 1 lb. of glue, and 1 lb. of powdered alum. Slake the lime with hot water, keeping it well covered during the slaking. Dissolve the glue, also the alum in boiling water, and add to the already slaked lime, taking care not to make too thin. Strain the whole either through a piece of canvas—a piece of chaff bag tied over the mouth of an oil drum will serve—or a fine mesh wire strainer, the wash being 'worked through' with an old brush. After straining, cover the limewash and allow to stand for two days or more, when it is ready for use. Apply with an ordinary two-knot brush, giving the work two coats, the first to be thoroughly set before the next is applied; and if on roofs or tanks, apply in cool weather. Colouring matter (ochre) may be added if desired. A little blue improves the appearance of the wash."

It is stated that applied to the roof of houses or stables during the hot season this wash will tend to keep such buildings cool "equally as well as the best refrigerating paint sold."

Brief Notes on Modern Silo Construction.

By C. R. Morris, Engineer, and G. J. Bosman, Agriculturist, Grootfontein School of Agriculture, Middelburg, Cape Province.

Appearance.—The silo may be built so as to be an ornament to any group of farm buildings and is adaptable to almost any style of construction, particularly with regard to the shape of the roof, which may be flat, conical, or at any desired pitch.

Location of Silo.—This is essentially most important. The site for a silo should be such that it can be easily filled and quickly emptied, or situated at no inconvenient distance from the growing crops and also close to the buildings in which the ensilage is to be distributed, so that the ensilage may be quickly distributed without a large amount of labour.

Air-tight Walls.—The fundamental principle in the preservation of ensilage when placed in a silo is the exclusion of air. To prevent the air from reaching the silage all silos must have air-tight walls, and, also, care must be taken that the doors are air-tight and fit closely into the walls. In addition to being air-tight the walls must be impervious, so as to prevent the loss of moisture from the silage. It is advisable to give a concrete silo a cement wash inside. Walls should be perfectly smooth on the inside to permit the silage to settle evenly without forming air-pockets, which causes a certain amount of silage to rot.

Size of Silo.—The quality of silage improves as the depth increases. Experience has shown that a silo should be of a depth not less than 30 feet.

Foundations of Silo.—These should be carried below the frost line and also to a depth to prevent blowing over. The space inside the silo and below the ground level can be utilized for ensilage.

Drainage.—Any soil will support a greater load when dry than when wet, and for this reason, unless the foundation lies in dry well-drained soil, a drain tile should be used to remove the ground water.

Floor.—It is advisable to have a concrete floor; this need not be more than 4½ inches thick laid on a cushion of broken stone or gravel 6 inches thick; the weight of silage, though great, is evenly distributed over the surface and would just as well support it if this floor was not used. But a concrete floor is impervious and is easily cleaned.

Cement.—Only the best portland cement should be used. The proportion of the mixture for concrete will vary according to the quality of metal and sand used. An essential in good concrete is thorough mixing.

Reinforcement.—The height of forms may vary from 30 inches to 36 inches. At each side of the continuous door a medium-sized bar of vertical reinforcement should be used, placed nearer the outside of the wall than the inside.

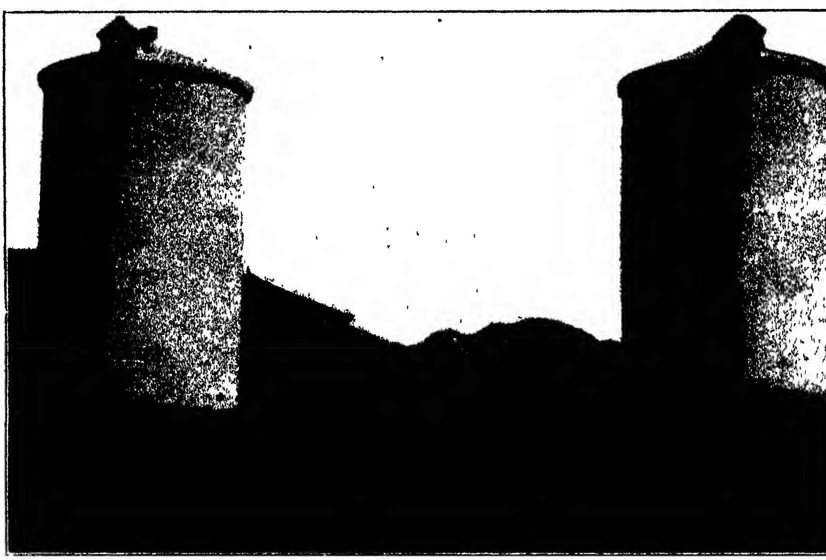
Forms.—It is advisable to have two sets of forms, so that the one set may be accurately placed before the lower set, which has been filled with concrete, is removed.

There are various types of forms and methods of erecting and fixing them into position. It is very necessary that whatever type

of form is constructed it is made strong enough to withstand all pressure brought to bear on it. A weak form will undoubtedly result in the walls of the silo being ill-shaped.

The Roof.—A silo with a roof has many advantages; there is less likelihood of the silage freezing, getting waterlogged with snow or rain. A silo without a roof catches a large amount of dust or anything carried in the wind. Furthermore, the roof also strengthens and protects the silo and adds a pleasing appearance. The pitch of the roof may vary from one quarter to one half. The steeper the roof the better, as the silage can be tramped to a higher level than would be the case if the roof were flat. Concrete roof has the same advantages as it has for other purposes.

Doors.—As already stated, doors should be air-tight, should fit tightly, and be flush with the wall on the inside and have a smooth inner surface. The continuous door is the type which is most popular



View of two Silos, showing opening of roof for filling.

in patent silos; the width should be such as to allow a man to enter the silo. Wood frames for the doors are to be avoided, inasmuch as they are likely to rot or cause air-pockets.

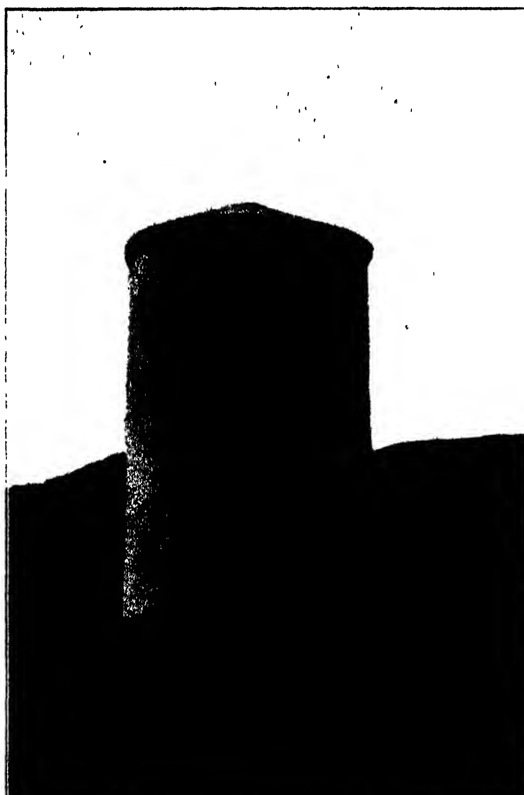
Walls.—The single wall concrete silo is the most common style of construction. A width of 6 inches reinforced horizontally and vertically seems to be the best thickness for the size of silos of the most commonly used dimensions.

SILAGE.

Crops for Silage.—The term silage is applied to the conversion of fodder plants, cultivated or of natural growth, into silage for the feeding of live stock. In this country, with its dry atmosphere and abundance of sunshine, the making of silage from grasses and crops like manna, etc., is not to be recommended. These crops lose very

little of their feeding value when made into hay and do not make such good silage as bulky succulent crops like mealies, kaffir corn, sorghums, and teosinte, which take some time to dry; ensiling is no doubt the best for preserving these crops. The crop that is most commonly used for ensilage in South Africa at present is the mealie crop.

When to Harvest.—One important phase in ensiling a mealie crop is the proper stage of growth or maturity at which the plant should be cut. It is unprofitable, and good ensilage does not result if immature plants containing a heavy percentage of water are cut, and, also, too much acid develops if the crop is insufficiently matured;

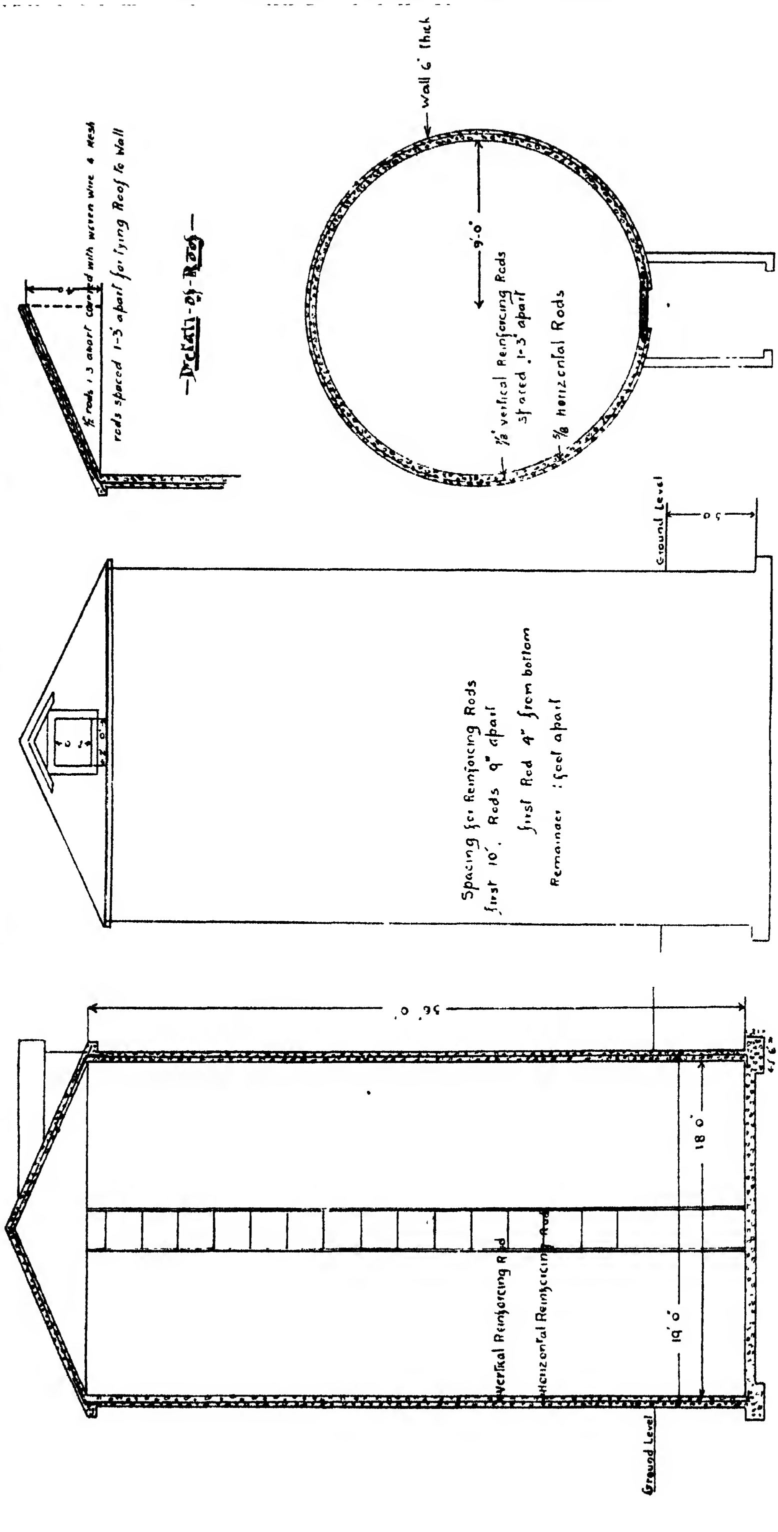


View of Silo, showing provision for emptying of silage.

if too ripe, it does not settle properly in the silo, and the air is not sufficiently excluded to prevent spoiling. The full-grown mealie, after the grain has begun to glaze with the lower leaf turning yellow and the upper ones still green, is the best stage at which to harvest the crop, which then provides the largest proportion of digestible matter.

Varieties to Plant.—When selecting a variety of mealie to plant for silage the following point should be taken into consideration. First, there must be a large yield of foliage which will be succulent and palatable.

Plan of Reinforced Concrete Silo erected at the Grootfontein School of Agriculture, Middelburg, Cape Province.



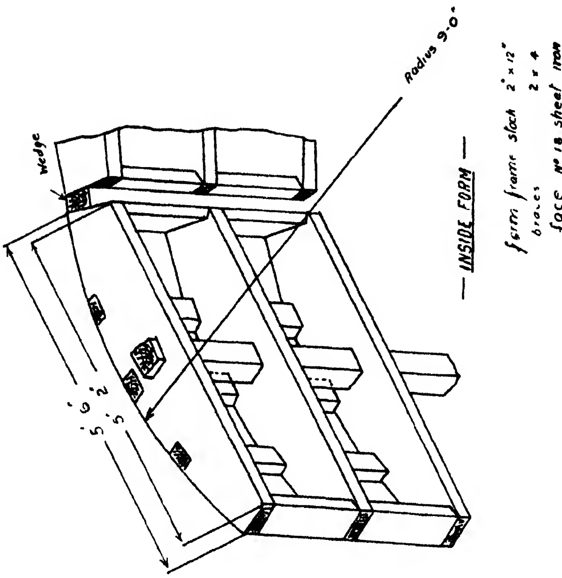
PLAN.

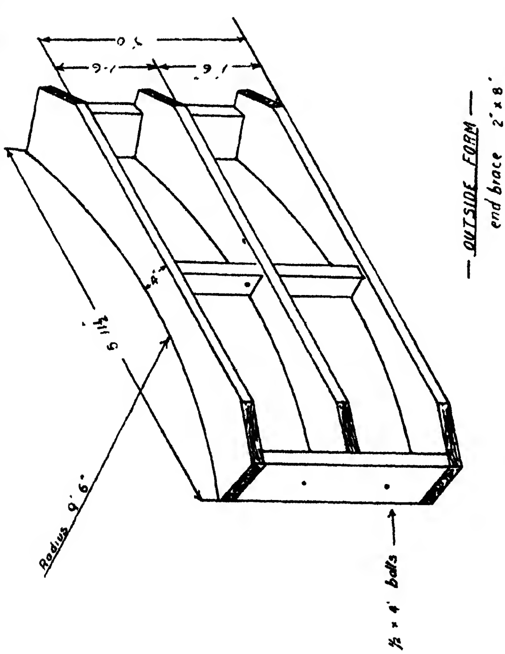
ELEVATION.

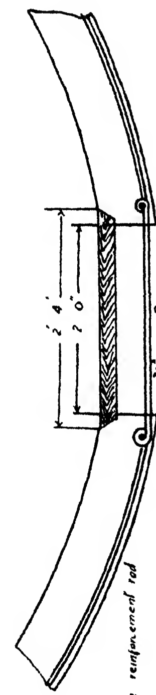
CROSS SECTION.

Scale: 10 feet = 1 inch.

Isometrical Drawing of Forms for Concrete.







Section of Continuous Door.

Second, there must be a large yield of ears to raise the percentage of digestible nutrients in the silage.

Third, in cold districts and when January sowing is practised, the variety must be early maturing in order to be ready for harvesting before the first frost falls.

The large varieties such as Natal Horsetooth, Boone County White, and others, will give the greatest amount of ensilage, but the variety best suited to each particular locality should always be carefully considered when laying down the crop.

Thickness of Planting.—This depends upon the following points:

First, fertility of land.

Second, the amount of rainfall.

Third, the length of growing season; where the growing season is short, thickly planted mealies will mature earlier.

Fourth, rank growing varieties should be planted thinner. As a general rule, mealies for silage purposes can be planted from six to fifteen inches in the rows, and the rows 2½ to 3 feet apart.

Method of Harvesting.—Mealies for ensilage are usually cut with a reaper and binder constructed for this purpose, but may also be cut by hand, where a machine is not available. Wagons follow the machine and convey bundles of cut stalks directly to the cutter. The silo is then filled by means of a combined silage cutter and blower, which chaffs the whole of the green plant, including the cobs, and blows the chaffed material up a galvanized iron pipe in at the top of the silo; these chaffers and blowers will dispose of huge quantities of material in an hour, but the size of the chaffer and blower depends on the size of your silo, etc.; a medium self-feeding machine will cut eight to ten tons per hour with an 8 horse-power steam engine.

Essentials in Silo Filling. If silage is to keep well, it must settle evenly, therefore the leaves and the heavier parts of the mealie plant must be kept thoroughly mixed and evenly distributed in the silo. Every time three or four inches of cut material is added it should be tramped down thoroughly, especially around the edges, thus packing the silage as much as possible round the sides, in fact, it is best to keep men tramping all the time the chaffer is working; the object of the tramping is to pack the material sufficiently to minimize the quantity of air present and so prevent spoiling. As a covering to the silage, straw or chaff may be used to a depth of from 4 to 6 inches. This covering, or top layer of chaff, should be wetted and well tramped down to exclude the air and thus preserve the silage below.

If the covering is not wetted, the heat generated dries out the silage, when may then "fire fang" to a considerable depth, giving rise to considerable loss. When a covering layer of chaff or chaffed lucerne is not available, a few inches of the silage on the surface will spoil.

Economical Side of Silage as Compared with Grain.—

	£	s.	d.
Yield of, say, 7 bags of mealies per acre, at 10s. ...	£3	0	0
Value of stover per acre, say	0	10	0
	£3	10	0

The value of a ton of silage is estimated to be £1 when compared with hay; and, therefore, an acre of land yielding ten tons of silage

would be worth £10 as against £3. 10s. for grain and stover, giving a difference of £6. 10s. in favour of the silage.

Cost of Silage Production.—The cost of producing mealie silage in the Transvaal is estimated (in Farm. Bull. 91) at 10s. to 12s. per ton; the figures are as follows:—

Ploughing, cultivation, seeding	£1	15	0	per acre.
Cutting and hauling to silo	1	15	0	,,
Chaffing, putting into silo	1	10	0	,,
	£5	0	0	

Total cost per acre, £5; at 10 tons to the acre, the cost per ton works out, therefore, at 10s.

Advantages of Silage.—In a country like South Africa, subject to great droughts like that of 1912, the use of succulent feed for stock is of the greatest assistance in keeping the animals alive and in good health and condition, and therefore silage becomes an invaluable asset to the stock farmer of South Africa. Silage for dairy cows is particularly valuable, because it markedly increases the milk flow; it is also splendid for fattening slaughter stock if used in conjunction with dry hay during the winter months. It is estimated that 85 tons of silage, obtained from approximately 5 morgen of land under mealies, will feed and keep in condition 340 sheep, or 85 oxen, or 55 dairy cows for 100 days; or 250 sheep and 12 oxen and 2 dairy cows for 109 days. These figures are obtained by calculating at the rate of 5 lb. of silage for a sheep, 20 lb. for an ox at work, and 30 lb. for a dairy cow, in addition to other roughage.

CAPACITY OF SILOS.

Dimensions.	Capacity in tons.	Acres of crop necessary (15 tons to acre).
10′ × 20′	28	3
12′ × 20′	30	3
12′ × 24′	49	3 2/5
12′ × 28′	60	4
14′ × 22′	61	4⅓
14′ × 24′	67	4⅔
14′ × 28′	83	5⅔
14′ × 30′	93	6
16′ × 24′	87	6 2/5
16′ × 26′	97	7
16′ × 30′	119	8
18′ × 30′	151	10 1/5
18′ × 36′	189	12⅓

The Rubber Industry in Natal.

By HERBERT NOYES (late of the Federated Malay States), Technical Adviser to the Tirucalli Rubber Concessions, Ltd., and the Reit Valley Tirucalli Rubber Co., Ltd.

IN view of the fact that the monthly output of Tirucalli rubber from Natal now exceeds 25,000 lb. of marketable coagulum, which figures should steadily increase from now onwards, prospective planters may be interested in this article.

In May, 1911, accompanied by Mr. Frederick Kaye, D.Sc., one of the leading English research chemists, I arrived from London to investigate the possibilities of Tirucalli rubber in Natal. It was not, however, until late in August of the same year that an English syndicate, having purchased the Tugela Concession on the south bank of the river of that name, deputed me to inaugurate the industry of rubber collecting on a large scale.

In the interregnum, no less than thirty-four different experimental methods of coagulating latex were tried and tested, as well as the majority of the tapping methods in vogue on Far Eastern plantations and those I have seen employed in Ceylon, India, Fiji, and elsewhere.

As regards the former, the result of careful investigation pointed to an admixture of tannic and hydrochloric acids as producing the best results and, as far as the work of extracting latex from the trees was concerned, the half herring-bone principle was finally adopted. Subsequent work has more than confirmed the wisdom of both methods, and my decision in the matter of tapping has since been approved by Dr. Schidrowitz and Mr. Herbert Right, the two leading authorities in the rubber world.

It is perhaps needless to say that since the inception of the industry the primary difficulty has been that of labour, firstly the recruiting of such, and next the drawback of being obliged to accustom the natives to the work, and incidentally of overcoming their firmly rooted prejudices where the handling of Tirucalli latex was concerned. It would, according to their article of faith, blister them, destroy their eyesight, and so on. Even now, in valleys where the industry is not being carried on, the same objection holds good. I may, therefore, take this opportunity of recording that in my eighteen months' experience of the latex, I have seen no cases of blistering and no instances of anything but temporary discomfort owing to the crude latex coming in contact with the eyes, and then irritation was easily allayed by an application of cocaine solution.

THE EUPHORBIA TIRUCALLI.

This variety of the Euphorbiaceae must not be confounded with the better known varieties of the same family, *E. grandidens* and *E. candelabra*, usually and erroneously known as Cacti. Without entering into botanical details, it may be briefly described as a hard-timbered, rough-barked, leafless tree of umbrageous habit, attaining, in good soil and under favourable conditions, a height of 25 to 35 feet and a

diameter of 1 to 2 feet. In lieu of leaves, it bears at the extremity of the branches, bunches of thin leathery fingers, which, when broken, yield a watery latex. The younger trees are usually of a darker green in colour than their elder companions, and their bark soft, easily incised, and of a grey-green colour.

The natural habitat of the tree is the hot valleys of Natal lying between latitudes S. 25 and 32. It is also found in quantity on the West Coast, and for some years has been exploited by the Portuguese at Angola, and its product shipped to Europe under the name of Almedina. I have also seen specimens of it in the Mozambique Province, but not in sufficient quantity to warrant serious consideration.

I am convinced that at no distant date the whole of the valleys of the Tugela, Umfolosi, Umgeni, and Umkomaas were covered with dense forests of Tirucalli, most of which have been ruthlessly cut out by the natives. Evidence of this may be seen in the existence of very large trees, fungus-covered and scaly barked, but otherwise thriving in stony kloofs and on barren hill-sides which the natives have not deemed worthy of cultivation. The late Cecil Rhodes, in one of his early letters, addressed from the Umkomaas Valley, where he was engaged in cotton planting, complained bitterly of the difficulty of extirpating it.

When it is realized that a well-grown tree is capable of yielding, in good hands, latex valued at 2s. 6d. per annum, the further destruction of this most valuable asset to Natal cannot be too emphatically deprecated.

The tree attains its highest development in rich deep soil, preferably in the vicinity of water, and, naturally, thrives exceedingly on old kraal sites. When a group of straight, clean-barked trees of any height are met with, it is safe to assume the previous existence of a native kraal. It evinces, however, a remarkably vigorous growth in any sort of soil, provided the altitude be not excessive. It will be found on rocky hillsides, occasionally, in country next to incapable —it would be thought—of sustaining any vegetable growth, oblivious of fires and droughts, and eminently an example of the survival of the fittest. It will be readily understood, however, that it is not from trees like this that the best tapping results will be obtained.

It reproduces itself freely and can be grown from seedlings or "stumps," precisely, in the latter case, as is the Para rubber of commerce. In many of the forests under my personal observation it suffers from overcrowding, and at a moderate estimate four-fifths of the younger trees might with advantage be removed.

As a rule, considerations of labour will not permit of the immediately unremunerative work of cutting out, and my own practice is to tap, heavily, all superfluous trees.

TAPPING.

As I have already indicated, the best system to adopt is the half herring-bone, quarter tapping. The boning should be at an angle of seventy-five, and, as a rule, it is advisable to keep the oblique cuts on one side of the vertical channel only. Thus, the fifth incision will bring the tapper to the second series of oblique tappings, and these should be made always on the lower side of the original. No further excision of the vertical cut is necessary, as this is to be regarded only as a channel to conduct the latex to the foot of the tree and into the collecting cup. (In respect to this last essential I may remark that a

Natal company now at work under the control of a very raw amateur indeed has evolved a system of tapping by vertical cuts only. By this means, half the cortex of the tree will remain untapped, and, as owing to the distribution of the lactiferous cells, a vertical cut leaves 25 per cent. of them untouched, the waste of time and labour will be enormous.)

Next to the ravages of the natives no greater danger to a new and promising industry can be imagined than the egregious ideas of amateur rubber experts; at the junction of the Tugela and the Inandi may be seen hundreds of dead trees, once tapped (?) by the original owners of the Tugela Concession.

The half herring-bone should be not less than 9 inches apart, and not extending beyond the reach of a well-grown man from the ground.

In fact, no distinction need be made between the tapping of Tirucalli and other rubber producers of the same family, notably the *Manihot glaziovii* and *Dichotoma*. The cellular distribution is practically identical, but, needless to say, extreme caution should be exercised in using the chisel. If it cut too deeply through the cortex and injure the delicate membrane of the cambium, the shothole borer or white ant will inevitably attack the timber, with disastrous effects to the tree. The former pest, indeed, appears heedless of the poisonous qualities of the crude latex, and will often attack the timber through the thin coating of coagulated latex that has dried on the incision. But instances are not common, and the recuperative powers of the tree appear sufficient to withstand these occasional assaults without its sustaining apparent damage.

The best chisel and one selected by me from some dozen varieties tested is the "Veteran Tang" made by Yates, of Birmingham. It can be obtained from Messrs. Dickenson & Fisher, of Durban. A native should become an expert tapper in a fortnight's time, but pending his acquiring the necessary skill, constant supervision is advisable if the trees are to be safeguarded.

The aluminium cups and collecting tins differ in no respects from those generally in use, and a short open spout of plain zinc, pointed at one end, has been found most effective.

Given healthy and well-grown trees handled with care, bi-weekly tapping is not too frequent. Tests made with small and inferior trees in badly placed positions and infested with fungoid growths gave me the following results which may confidently be accepted as the absolute minimum:—

TAPPING RESULTS FOR THREE WEEKS.

Quarter Tapping. Half Herring-bone System. Bi-weekly.

No.	Average Diameter.	Compass Bearing.	Shade Temp.	Time.	Result, in oz.
			F.		
1st	6 inches	North	80	11 a.m.	3 3/16
2nd (at three days' interval)	"	East	82	2 p.m.	1 3/4
3rd " " "	"	South	79	10 a.m.	1 3/16
4th " " "	"	West	85	1 p.m.	1 3/4
5th " " "	"	North	75	10 a.m	1 1/4
6th " " "	"	East	80	2 p.m.	2 1/16
				Total	11 3/4 oz.

COAGULATION.

The best results are obtained by treating the latex after keeping for periods varying from twenty-four hours to seven days according to the ruling temperature. During spells of abnormally hot weather it will be found advisable to treat twenty-four hours after collection, otherwise natural coagulation will set in on the surface and the quality of the product will be unequal.

If it is proposed to submit the product to a subsequent and exhaustive extraction process, an admixture of tannic and hydrochloric acids will be found the best coagulants. For ordinary commercial purposes a solution of tannic acid will be found the best agent.

I append a table of comparative results, showing normal differences between the coagulation of fresh and other latex.

Ordinary oaken hogsheads, sawn in half, make the best settling-tanks. Extreme care should be taken to screen the latex and to keep it covered from dust whilst the hardening process is in course. Twelve hours should show a thick crust on the surface; if advisable this can be removed to a depth of six inches or so, when contact with the atmosphere will result in the residue of the liquid rapidly hardening.

When coagulated the product assumes a granulated form which is highly impregnated with water, the solid contents of pure latex varying from 50 per cent. to 69 per cent. If in good order it should be of a yellow tint, slightly tinged with green.

A wooden spade is the best article to use for shovelling the material into a jacketed vessel, which failing a more scientific apparatus may assume the form of an ordinary paraffin tin. This primitive utensil is placed in a larger one, and the contents heated to a temperature of 60° Centigrade. It is important that it should not be permitted to boil, nor should water nor any other metal be allowed to come in contact with the material. Frequent stirring will ensure against adhesion, and result in the coagulum being thoroughly well heated.

From a granulated form it then alters to a sticky homogeneous mass of the consistency of thick glue and will exhibit remarkable resilience and elasticity. It should be pressed and blocked whilst warm into convenient and uniform blocks, and will be, when thoroughly dried, ready for packing and shipping.

A moisture percentage of at least twenty-five should remain, of which 10 per cent. will disappear between the port of embarkation and London. I have found that the margin of safety is represented by at least 25 per cent.; a lesser figure might possibly lead to oxidization in the tropics, or the misfortune of seeing the product arrive in that state of partial decomposition usually known to practical rubber planters as "tackiness."

Under no circumstances should the coagulum or the latex be exposed to the rays of the sun or to undue heat whilst in transit; on the contrary, it will be found that once the treating process is complete no amount of cold water will affect the rubber injuriously. If insufficiency of storage room exists, a good plan is to cover the material with ordinary muid sacks and keep constantly damp.

Blocking to a size of 25 lb. weight is recommended; indeed, the larger the better, as the surface exposed to possible deterioration should be as small as it can conveniently be made.

Coagulating Tests. Comparative Values of Fresh and other Latices.

FRESH LATEX.

No. 1.—Acid Tan.: 1 : 5000 / Acid Hydcl.: 1 : 500 } No result in twenty-four hours.

Re-treated in twenty-four hours with

Acid Tan.: 1 : 10,000 / Acid Hydcl.: 1 : 500 } Coagulation in nine hours.

Weather cool. Temperature 75° F. (mean).

No. 2.—Acid Tan.: 1 : 2000 / Acid Hydcl.: 1 : 500 } No result in twenty-four hours.

Re-treated in twenty-four hours—

Acid Tan.: 1 : 8000 / Acid Hydcl.: 1 : 500 } Coagulation in nine hours.

Temperature 68° F. (mean).

No. 3.—Same result as No. 1. Temperature 78° F. (mean).

No. 4.—Same result as No. 2. Temperature 64° F. (mean).

SEVEN-DAY OLD LATEX.

No. 1.—Acid Tan.: 1 : 5000 / Acid Hydcl.: 1 : 500 } Coagulation in eighteen hours.

Temperature 74° F. (mean).

No. 2.: Acid Tan.: 1 : 2000 / Acid Hydcl.: 1 : 500 } Coagulation in eight hours.

Temperature 66° F. (mean).

No. 3.—Acid Tan.: 1 : 4000 / Acid Hydcl.: 1 : 500 } Coagulation in twelve hours.

Temperature 62° F. (mean).

No. 4.—Acid Tan.: 1 : 5000 / Acid Hydcl.: 1 : 500 } Coagulation in three days, without re-treatment.

Temperature 72° F. (mean).

No. 5.—Acid Tan.: 1 : 2000 / Acid Hydcl.: 1 : 500 } Coagulation in three days, without re-treatment.

Temperature 61° F. (mean).

Separate tests made with fresh latex in a mean temperature of 83° F. resulted in complete coagulation in twelve hours with the following formula:—

Acid Tan., 1 : 2000.
Acid Hydcl., 1 : 500.

FIELD WORK.

Once habituated to the work the natives take to tapping and the subsequent treatment readily enough. It will usually be found in the beginning that there exists, however, a certain amount of prejudice in their minds against the tree. It is their custom to ascribe to the latex all sorts of injurious and fictitious qualities, but a short

experience quickly convinces them that contrary to accepted belief no ill-effects follow on contact of the juice with the human skin. When splashed into the eyes, irritation no doubt results, but a few drops of castor-oil or a 5 per cent. solution of cocaine and water speedily allays the pain and removes the offending liquid.

It is best to guard against any risk of misadventure by serving out goggles with protective side-pieces. The majority of boys will invariably discard them after a few days, and, as a matter of fact, I have noticed that expert tappers with unprotected eyes rarely suffer from the accident of contact. A far more common source of this lies in the possibility of boys rubbing dirty hands over their faces at night. Cleanliness is a factor not to be lost sight of when dealing with the product in any form.

Thus, it is essential that no cooking or eating utensils should be allowed to remain in the vicinity of the latex store. I have seen cases of severe abdominal disorder owing to a meal having been cooked in a pot which long before had originally contained crude latex. The attack, however, quickly passed on a liberal exhibition of crude castor-oil. Nevertheless, it is certain that the latex of the Tirucalli contains an identified element of a more or less volatile and injurious nature, and that in this, as in similar industries, ordinary care must be exercised by those in charge.

One white man should suffice to look after a gang of at least twenty-five boys, who, on an averagely hot day and amongst good trees, should each make a first tapping of eighty trees. Calculating the first excision as productive of 3 oz. the formula $80 \times 3 - 16$ will give what I consider the minimum of one native's daily output of liquid latex, viz., 15 lb. On the other hand, many boys will bring in 20, 25, or 30 lb. daily, and it is worthy of note that it is usually the umfaans of from twelve to sixteen years of age who generally produce the largest individual output. I ascribe this to their greater industry, their anxiety—when paid by results—to earn more than their fellows, and the fact that not having arrived at years of indiscretion, smoking, snuffing, and bandying casual obscenities with passing females, does not appeal to them.

A gang working a forest should not be allowed to split up and stray, but be kept in fairly close order and under constant supervision. Otherwise they will select only the finest and straightest trees, tap carelessly, and not infrequently add water to their latex. It must always be borne in mind that the life of the trees is indefinite and their productiveness an annual occurrence. Unfortunately it is difficult to make the natives look so far ahead as to consider twenty or thirty subsequent tappings.

Regarding adulteration, I have found that where employed, women are incorrigible offenders in this respect. Whilst I was experimenting in the Tugela Valley many women were detected in adding anything up to 75 per cent. of water, carefully mixing wood ashes the while to increase the viscosity, and finally handing in their tins with the utmost effrontery and assurances of the good value they brought.

An ordinary hydrometer is a useful article in a camp, but after a little time the practised eye will easily detect adulteration however artfully carried out; a drop of latex placed on a finger-nail and shaken off reveals the purity or otherwise at once.

CULTIVATION.

Now that the value of the Tirucalli product has been established beyond all controversy, and markets—wherein, let it be clearly understood, the supply falls lamentably short of the demand—assured in Europe, it is certain that in the cultivation of the tree a new and profitable industry is open to all owners of thorn farms in Natal and Zululand. And, so far as I can see, there is no reason why in the low country of the Transvaal the planting of Tirucalli should not become an extremely lucrative proposition.

The tree is hardy to a degree, drought-resisting, will grow anywhere—if severe frosts are not indicated—where sufficient heat obtains, and is not particular as regards soil. Alternatively it will respond to an astonishing extent in good soil to a very small amount of attention, such as occasional weeding and, of course, protection from fire. Ploughing is unnecessary, it suffices to hole only; contiguity to water is desirable.

The ideal method of laying out a plantation would be to cut Tirucalli saplings from an overstocked natural forest, selecting 6 feet lengths of straight, clean-barked trees of from 2 inches to 3 inches in diameter. These, I have proved, will throw out branches and foliage within six months of planting, and can be tapped, with good results, within two years from striking. Failing the presence of the tree on a property or in the neighbourhood, I suggest planting what are known in Para or Ceara plantations as "stumps" or seedlings. (And I may take this opportunity of saying that I shall be pleased to put any readers of the *Agricultural Journal* into communication with owners of natural nurseries of the Tirucalli tree.)

These seedlings should, in my opinion, reach the productive stage—with anything like favourable conditions—in four or five years' time. Assuming that 500 trees be planted to the acre—and, personally, I should exceed this figure—within five years each tree should yield 2 lb. of crude rubber per annum, which, at 8d. per lb.—the ruling price at the moment—will afford a gross profit of £36 per acre. The second year of tapping should give 25 per cent. better results, and although I am not in a position to estimate further with any degree of certainty and beyond actual experiments, there exists no reason why the annual output should not increase with the ratio of age in the same manner as other cultivated rubber producers.

And, working costs, owing to the many and varying conditions of labour obtaining throughout the Union, would be next to impossible to estimate. Roughly speaking, a native should, I think, in easy country plant an acre a week. Protection from fire and in half-yearly clearing of weeds round the stumps should not prove costly; over and above these precautions, the tree can look after itself.

MARKETS.

Many analyses of the Tirucalli rubber have been made by official and other analyists in Great Britain and on the Continent. From some dozens of results obtained by leading rubber authorities in London and elsewhere, I average the composition of the coagulum as follows:—

Caoutchouc (pure rubber)	13.5
Resin	74.3

Proteid	1.2
Insoluble matter	7.8
Ash	3.2

It is, however, only fair to state in regard to actual rubber contents that some results have given as high as 17 per cent.

It was our original intention to inaugurate an extraction process similar to that in use by producers of Guayule, Balata, etc., with a view to separating the rubber and resinous contents of the coagulum —by which term the solidified latex is known—and as it had been ascertained that the rubber came up to within 80 per cent. of the value of best Para, and that the resin had a specific value, there is no doubt that such an undertaking would have succeeded. But subsequent inquiries, tests, and practical demonstrations proved that there existed a very great demand for the coagulum in its crude and unconcentrated form. Further, that if the manufacturers of rubber articles, who found the Tirucalli product admirably adapted for mixings, etc., were assured of a uniform supply, there was every possibility of the price increasing. Such, I believe, has been the history of the mimosa bark and many other raw products, and there is every indication that the value of our rubber is rising as it becomes better known. It can be used for an infinity of purposes, a detailed description of which does not, perhaps, come within the scope of this article. The fact stands out clearly that even at its present price a by no means inconsiderable profit can be made. For with anything approaching cheap labour, the production cost among matured trees should not exceed 4d. per lb. And it should be remembered that, although in the case of cultivated trees a period of waiting has to be considered, the subsequent working costs would be far less than in the forests of indigenous trees. Also, if other cultivated varieties are any index, the tapping results would be far better.

The Toxic Properties of Arsenite and Arsenate of Soda.

By J. MULLER, B.A., F.C.S.

It has been urged repeatedly that the isometer instrument, now so largely used by owners of dipping tanks, although useful in determining approximately the strength of a freshly prepared dipping wash, is not sufficiently reliable for ascertaining the quantity of arsenic present in a dip several weeks old.

The fact is that only the arsenic existing in the wash as sodium arsenite is determined by means of the isometer, whereas that present in the oxidized form (i.e. as sodium arsenate) is not so determined.

Farmers have repeatedly complained to me that dipping solutions, prepared either from arsenite of soda or from some of the more common proprietary arsenical liquid dips, scald the cattle and yet possess very low tick-killing properties.

In several instances this has been verified by the writer, and during my stay in the dipping areas a number of experiments were made as well as subsequent tests in the Government Chemical Laboratory at Grahamstown.

The following will serve as a good illustration of the changes that a dipping solution may undergo in the dipping tank.

During 1911 a municipal cattle tank in the Eastern Province was cleaned and the dipping mixture (arsenite of soda) allowed to run into a sort of dam three to four yards outside the fence round the dipping tank. Some weeks later, nine calves drank of the water from this pool, which was not fenced in, and died. According to the statement of the owners, they appeared to be in great agony, suffering great pain, and were completely doubled up—all the symptoms pointing to poisoning.

The organs of three of these young heifers were sent to me for analysis, the quantities of arsenic found in their respective organs being quite sufficient to lead to the conclusion that they had died from arsenical poisoning.

The councillors, however, refused to believe that the water in the pool was the cause, but to satisfy the owners, who were pressing their claims for compensation, they caused the Town Clerk to submit two samples of the water taken from different parts of this pool, and as full-grown frogs were seen to be still swimming in this pool the water was held to be quite harmless.

On analysis, the following amounts of arsenic were found:—

	In grains per gallon.	
No. of sample...	I.	II.
Sodium arsenite (as As_2O_3)	5.2	4.46
Sodium arsenate (as As_2O_3)	24.59	26.66
Total arsenic (as As_2O_3)	29.79	31.12

It was therefore quite evident that the pool of water, although containing only about five grains per gallon of arsenite of soda, was yet very dangerous in that the total quantity of arsenic held in solution would most decidedly poison stock drinking the same.

The tank had previously been cleaned because the dip wash had not been giving satisfactory results although prepared some months before according to the directions laid down by Government Proclamation, viz.: 4 lb. of arsenite of soda (68 per cent. of As_2O_3) to 100 gallons of water, or approximately 187 grains of arsenious oxide per gallon of wash.

It was therefore quite apparent that the oxidation of the arsenic from the arsenite to arsenate through the agency of a micro-organism or organisms not yet identified must have proceeded very rapidly in the dipping tank, the conditions of temperature, mediums, etc., all influencing rapid bacterial growth.

The curious feature, however, was the fact that frogs appeared to be quite at home in the arsenical water which had caused the death of the calves, and, as on several previous occasions farmers had reported their presence in non-efficient dip washes, experiments were made with a view to determine the toxic properties of arsenite and arsenate of soda, respectively, on frogs.

EXPERIMENT 1.

Two healthy and vigorous frogs were placed in a little more than two gallons of water to which arsenite of soda had been added in the proportion of 3.7 grains of arsenite calculated as arsenious oxide (As_2O_3) per gallon of liquid and allowed to swim, with the following results:—

End of first day: Two frogs apparently quite normal.
End of second day: One frog dying and the other seedy.
End of third day: One died and the other dying.
End of fourth day: Both dead.

EXPERIMENT 2.

Four healthy and vigorous frogs were allowed to swim in about two gallons of water containing 4.1 grains of arsenate of soda calculated as As_2O_5 (equivalent to 3.53 grains of As_2O_3) per gallon of water, with the following results:—

End of first day: All alive and apparently quite well.
End of second day: All alive and apparently quite well.
End of third day: All alive and apparently quite well.
End of fourth day: Two apparently well and two seedy.
End of fifth day: Two apparently well and two dead.
End of sixth day: Two seedy.
End of seventh day: All dead.

EXPERIMENT 3.

Two healthy frogs were placed in same quantity of water as above, but nearly double the strength of the solution used in Experiment 2, viz., 8 grains of arsenate of soda calculated as As_2O_5 (equivalent to 6.9 grains of As_2O_3) per gallon of water.

These appeared to be restless within two hours and were both dead within eight hours from the time of immersion.

During each experiment food was supplied to the frogs, but only in the last case was it left untouched by them.

It is very difficult to reconcile these experiments and results with the statement that frogs were swimming in the water of the pool containing as much as 30 grains of total As_2O_3 per gallon.

What appears possible is that arsenic in the form of sodium arsenate is not quite so effective on the frog as sodium *arsenite*, and it is most probably correct that the tick-destroying power of a given quantity of arsenite of soda is far greater than that of the same proportion of arsenate of soda. In this connection, therefore, Messrs. Cooper and Laws' paper on the "Tick-killing Properties of Sodium Arsenate," appearing in the last issue of the *Agricultural Journal*, will be read with much interest.

According to Rideal,* Miguel found that there was required 6 grammes of arsenious oxide per litre to prevent bacterial growth in beef tea, and that 9 grammes of arsenate of sodium were required to accomplish the same purpose.

To stock-breeders who dip their cattle regularly, it is most important that a periodical estimation of the arsenical contents of the dipping tank should be made in order to ascertain the amounts of *arsenites* as well as *arsenates* present in the wash.

Such determinations cannot be obtained by means of the isometer instrument, as the latter takes no account of the arsenate, and therefore it is essential that samples of the wash (8-10 oz. bottle) be forwarded to the nearest Government Analyst for such analysis.

The Tick-killing Properties of Sodium Arsenate.

By W. F. COOPER, B.A., F.C.S., F.Z.S., and
H. E. LAWS, B.Sc., F.I.C.

SINCE Brunnich† published the results of his observations on the comparative efficiency of sodium arsenite and sodium arsenate many workers have been engaged in determining the amount of oxidation which takes place in an ordinary cattle dipping bath containing, amongst other ingredients, a solution of sodium arsenite.

Brunnich established his results as the outcome of tests carried out in accordance with the Queensland Government Regulations, which enforce the analytical examination of all dipping preparations in the laboratory and a practical test on tick-infested cattle. A certain proprietary arsenical cattle dip was found to contain the standard quantity of arsenic, but when tested on tick-infested cattle it was discovered that its tick-killing power was below the standard required. On further chemical examination it was found that the arsenic was almost all present as arsenate instead of arsenite, to which fact, in the absence of other causes, the deficiency of killing power could only be attributed.

* "Disinfection and Preservation of Food." New York, 1903, pp. 176–177.

† "Notes on Dipping Fluids: Composition and Change during Use." By J. C. Brunnich, F.I.C. Read before Australasian Association for the Advancement of Science.

From Brunnich's results it is evident that for a dip to possess its maximum tick-killing effect the arsenic must be present as arsenite, and not arsenate. Lounsbury* and Watkins-Pitchford† have since shown that arsenic in the form of arsenate is less effective as a tick-destroyer than arsenite. The publication of these results induced Brunnich to make further investigations on the oxidation of arsenite to arsenate in a cattle dipping bath. He showed that oxidation takes place when air is bubbled through a solution of sodium arsenite, and that this also occurs, on a larger scale, when cattle plunge into the dipping bath.

From the examination of samples of the contents of used dipping baths, Cooper and Freak‡ have been able to confirm these observations.

Fuller§ examined the contents of cattle dipping baths after they had been standing for different periods, and found that practically no oxidation took place for a month after the dip had been mixed, but within four months of the mixing 90 per cent. of the arsenite in the dip had been oxidized to arsenate. He attributed the oxidation to the action of bacteria, the rate of oxidation depending on the quantity and nature of the organic matter present.

His results show that, on being inoculated with a small quantity of the wash from a used bath, the arsenite in a plain solution of a pine-tar cattle dip did not oxidize to any great extent. If, however, a small quantity of a suitable culture medium (e.g. sterilized broth urine, etc.) is added, oxidation proceeds rapidly. A plugged flask containing an arsenite pine-tar dip so treated oxidized to such an extent in the course of one month that the original arsenite content decreased from 2 per cent. to 0.01 per cent.; in other words, 95 per cent. of the arsenite had been oxidized to arsenate. Further experiments on these lines are in progress.

In the light of these experiments, that sodium arsenite becomes oxidized in a cattle dipping bath to sodium arsenate is established beyond doubt, but the precise conditions which influence the rate of oxidation are not yet known.

The amount of depreciation in tick-killing power of an arsenical dip, due to this oxidation, has still to be determined, and to this end the relative tick-killing power of sodium arsenite and arsenate must be ascertained. This being known, and also the extent to which oxidation has taken place in the dip, the loss of tick-killing power can be estimated.

At present it is customary to look upon the sodium arsenite as the only tick-killing agent, and to regard the arsenate, produced by oxidation, as entirely useless. As a matter of fact, this conclusion is open to criticism for two reasons: (1) the tick-killing powers of a dip are not always proportionate to its arsenical content; (2) sodium arsenate has *some* value as a tick-destroying agent.

Though the first point is interesting it does not concern us here. The second is, however, important on account of the persistent assumption that the sodium arsenate in the dipping bath is an inactive constituent.

* Lounsbury, C. P. † Watkins-Pitchford, Lieut.-Col. H.

‡ *Journal of Agricultural Science*, vol. iv, part 2, "Oxidation of Arsenites to Arsenates in Cattle-dipping Tanks," by W. F. Cooper, B.A., F.C.S., and G. A. Freak, B.Sc., A.I.C.

§ United States Department of Agriculture Bureau of Animal Industry, Circular 182. "The Spontaneous Oxidation of Arsenical Dipping Fluids," by Aubrey V. Fuller.

When in South Africa, investigating means for destroying ticks, the writers of these notes made some experiments on the relative value of sodium arsenite and sodium arsenate as tick destroyers, but at the time the subject did not appear to be of sufficient general interest to justify publication.

The results of these experiments are given on the following pages, and show clearly that, although the tick-killing effect of sodium arsenate is less than that of sodium arsenite, there is no justification at all for the supposition that the sodium arsenate is useless as a toxic agent. A single application of sodium arsenate, when used at sufficient strength, in combination with one of the standard emulsions, was found to kill all the ticks on an animal. From these results it appears that sodium arsenate possesses about 40 per cent. to 50 per cent. the tick-killing effect of sodium arsenite, and if this be the case, it is certainly a factor to be reckoned with in calculating the tick-killing power of a dip.

EXPERIMENTAL OBSERVATIONS OF THE RELATIVE TICK-KILLING POWERS OF SODIUM ARSENITE AND ARSENATE.

In these experiments the object has been to determine the relative activities of sodium arsenite and sodium arsenate, and no attempt has been made to ascertain the strength at which sodium arsenate will kill all the ticks without injury to the cattle. A sufficient quantity of sodium arsenate not being available for the purpose of filling a large cattle dipping bath, the experiments were made on a small scale with a bucket spray pump.

To obtain reliable results a method was adopted which experience showed to be most satisfactory in investigations of the comparative efficiencies of different dips, viz., spraying the animal, in two portions, with the two fluids which are to be compared, applying one solution to the front half of the animal and the other to the hind part.

The killing action of arsenite and arsenate was compared both in plain solution, and also when mixed with an emulsion.

Experiment 1.

Beast No. 2010. Well infested with bont ticks as well as blue, red, and brown ticks.

A. Arsenate Dip—

Sodium arsenate (As_2O_5)	1.0
Emulsion I.	2.5
Water	400.0

B. Arsenite Dip—

Sodium arsenite (As_2O_3)	1.0
Emulsion I.	2.5
Water	400.0

Beast sprayed on front portion with A.

Beast sprayed on hind portion with B.

Results.

A. Arsenate Dip—

One female bont tick dead, six still alive.

All the small blue ticks were dead, but most of the gorged females still alive.

B. Arsenite Dip—

With the exception of two gorged blue ticks and a female bont tick all killed.

The arsenite dip gave results which were roughly 50 per cent. better than those of the arsenate dip.

Experiment 2.

Beast No. 3000. Well infested with blue and red ticks, the latter being mostly larvae and nymphs in the ears; only five female bont ticks.

A. Arsenate Dip—
As in Experiment 1.

B. Arsenite Dip—
As in Experiment 1.

Beast sprayed on front portion with A.
Beast sprayed on hind portion with B.

Results.

A. Arsenate Dip—
Four female blue ticks still alive.

B. Arsenite Dip—
Three female bont ticks still alive.

The experiment was carried out as a duplicate of Experiment 1, and as in the latter case, B was considerably more efficient than A.

Experiment 3.

Beast No. 0102. Well infested with blue ticks, particularly between hind legs and on dewlap; not many bont ticks present.

The same spraying fluids were used as in the first experiment, except that a different emulsion was employed.

A. Arsenate Dip—

Sodium arsenate (As_2O_5)	1.0
Emulsion II.	2.5
Water	400.0

B. Arsenite Dip—

Sodium arsenite (As_2O_3)	1.0
Emulsion II.	2.5
Water	400.0

Beast sprayed on front portion with A.
Beast sprayed on hind portion with B.

Results.

A. Arsenate Dip—
About 50 per cent. of the ticks on the dewlap were destroyed.

B. Arsenite Dip—
Considerably more than 50 per cent. of the ticks on the hinder portions of the body were killed.

The general result is much the same as in Experiment 1.

Experiment 4.

Beast No. 0201. Well infested with red ticks, blue ticks, and male bont ticks; only six female bont ticks noted.

The spraying fluids used in Experiment 1 were employed in this case, with the difference that the *arsenite dip* was applied to the front portion of the body and the *arsenate dip* to the hinder portion.

Results.

A. Arsenate Dip—
A few male bont ticks and female blue ticks still alive. All female bont ticks alive.

B. Arsenite Dip—
Only two female bont ticks alive.

Experiment 5.

Beast No. 0300. Well infested with blue ticks and red ticks; only one female bont tick noted.

The spraying fluids used in Experiment 3 were applied in this case, with the difference that the *arsenite dip* was applied to the front portion of the body and the *arsenate dip* to the hinder portion.

Results.

In this experiment the *arsenite dip* showed a greater killing power than the *arsenate dip.*

Experiment 6.

Beast No. 3030. Well infested with red ticks, blue ticks, brown ticks, and bont ticks.

A. Arsenate Dip—

Sodium arsenate (As_2O_5)	1.0
Water	300.0

B. Arsenite Dip—

Sodium arsenite (As_2O_3)	1.0
Water	300.0

Beast sprayed on hind portion with A.

Beast sprayed on front portion with B.

Results.

The *arsenate dip* had about 50 per cent. of the killing power of the *arsenite dip.*

CONCLUSIONS.

Unfortunately the writers had to leave Gonubie Park before the commencement of the next tick season, and this work was carried out in the winter months when ticks were scarce, and at a time when the few available tick-infested cattle were required for more important purposes. In consequence the experimental work was not satisfactorily completed.

From the *little* that was done, however, it is clearly evident that sodium arsenate has *some* tick-killing action, although its power is not more than 50 per cent. of that of sodium arsenite.

At the same time, the results of the foregoing experiments may prove of value to other workers who desire to establish more definitely the relative values of sodium arsenite and sodium arsenate as tick-destroying agents.

In some tick-infested countries veterinary authorities have established the principle of judging the activity of a cattle dip solely on its content of sodium arsenite. In the light of the above results the mistake of adopting such a course is obvious. As Fuller has shown (see p. 717), under certain conditions 90 per cent. of the sodium arsenite in a cattle dipping bath oxidized to sodium arsenate within four months. In such a case, to comply with the regulations, the owner of such a bath would be compelled to add 90 per cent. of the standard quantity of arsenite to bring the bath up to strength. As a matter of fact, by doing so, he would raise the tick-killing action to over 30 per cent. above the standard. If the bath were left for a further term of four months an additional 90 per cent. of sodium arsenite would be required to bring it up to standard arsenite strength; and the real tick-killing power of the bath would then be about 70 per cent. above standard.

From such an instance it is obvious that to judge the activity of a dip solely on its content of sodium arsenite (as, for example, by means of the isometer) is to incur risks of a very serious nature, especially when oxidation has taken place to any great extent.

The only true test of the activity of a cattle dip is to test it on tick-infested cattle, when it will be found that even those dips which contain exactly the same quantity of sodium arsenite as well as arsenate are not all equal in effect.

In any case, any testing of the activity of a dip which takes no account of the tick-killing action of sodium arsenate can give only false results and should not be adopted under any circumstances.

NOTE.—Since writing the above notes one of the authors of this paper has had the opportunity of carrying out further tests on the tick-killing effect of arsenate of soda, and hopes to be able to publish the results of these later experiments in due course.

Distribution of Water.

By "KIKVORSCH" (R. J. VAN REENEN, Bloemfontein).*

INTRODUCTION.

IN South Africa where to so great an extent we are dependent on irrigation for the successful production of crops, the distribution of the water over the lands is naturally a matter of great concern to a very large proportion of our farming population. Too often, however, it is looked upon as a very minor detail and neglected accordingly.

For the purposes of this essay, distribution will be taken to mean the methods of dealing with the water after it has reached the corner of the land to be irrigated, without taking into consideration the means employed in conveying the water to this point.

The different methods of applying water to the land will first be briefly described, and subsequently the advantages and disadvantages of these different methods will be discussed in so far as they are affected by varying conditions of water supply, soil, slope, etc. Each system will at the same time be also more fully gone into.

GENERAL.

A good distributary system should fulfil all of the following requirements:—

(1) It should supply sufficient water without waste.
(2) It should distribute water uniformly over the land.
(3) It should not cause scouring.

* Second prize essay in the S. A. Irrigation Association's recent competition.

(4) It should permit of ready and effective drainage and not cause the formation of pools.
(5) It should permit of rapid irrigation at a low cost per morgen.
(6) It should not require earthwork of such a nature as to interfere with the cultivation of the soil after each watering, or with the reaping of the crop.

Broadly speaking, all methods of distribution fall under one of the following four heads:—

1. Distribution by flooding.
2. Distribution by furrows.
3. Basin irrigation.
4. Distribution by checks.

DESCRIPTION OF METHODS.

Distribution by Flooding.—By this system (not to be confused with flood schemes) is meant the application of water to the land in small streams emanating from several points on a feeder furrow, these streamlets being then forced to spread out in a thin more or less uniform sheet over the area to be irrigated.

The main feeder runs down the steepest slope of the field, with smaller furrows perpendicular to this or practically parallel with the contours at distances apart varying according to the nature of the crop and the slope of the ground.

The parallel furrows are laid out with little fall, so that on being dammed, back up the water for some thirty yards or more. Dams for these furrows can be made in several ways, either of earth alone, or of earth and manure. This latter is a good way when the application of a fertilizer to the soil becomes necessary. The earthen and manure dams are made on all points in the furrows prior to commencing irrigation, and on breaching these dams in the process of leading, the manure is washed on to the land. Canvas dams made of pieces of old bucksail, stretched on the cross piece of a wooden T frame, may be substituted for earth dams. They are put in position with the cross piece lying across the banks of the furrow and the leg lying slantwise with its toe pointing upstream. The canvas is placed on the upstream side of the frame and should be so large as to leave a margin of five to nine inches folded against the bottom and sides of the furrow. One or two shovelfuls of ground on this margin will keep it in position, while the pressure of the water on it makes the whole sufficiently watertight. Tappoons or iron sheets cut into a rather rough D shape, somewhat larger than the furrow section, and supplied with a handle, are excellent for temporary dams. They are pressed down into the soil of the bed and sides of the furrow, and answer well in tough soils; but unless considerably larger than the furrow cannot stand in very sandy soils.

Above these temporary dams made by one or other of the methods described, small openings are made, particularly on crests of ridges, and thereby the water is spread over the land. Unless the ground is particularly uniform in slope, it is found that the water tends to collect and run down small depressions or little valleys, so should be carefully watched. When the ground is very irregular it is usual to have the next furrow fairly close, and allow the surplus water to be caught up and redistributed in a similar manner.

In certain instances, as for example in the irrigation of wheat, oats, or similar crops sown in drills more or less parallel with the contours, this method, as described above, is not practicable without certain modifications, as the close growing stools, except on very steep ground, effectively prevent the passage of the water across the rows. It then becomes necessary to run the main feeders parallel with the contours and the minor furrows down the steepest slope.

Distribution by means of Furrows.—This system consists of turning water down one or more small furrows six or eight inches wide, which run between rows of the standing crop. The principle, of course, lies in the fact that while running down these furrows the water is continually soaking into the ground, and spreading out in all directions, thereby thoroughly saturating the subsoil. The water may be so regulated as to keep the furrows running for perhaps forty-eight hours without escaping from the bottom; or the furrows may be run fairly full and the surplus water caught up again by other furrows running perpendicular to them.

In the former method some fairly expensive scheme for accurate regulation may be provided and the method is especially adapted to the irrigation of orchards; while the full furrow method is cheaper and more particularly useful in the watering of vegetables or even cereals when sown in drills.

Furrow distribution has the great advantage of retaining a loose unbaked soil next to the stems or tubers, and of reducing the field actually wetted on the surface, simultaneously with the reduction of the area necessary to be cultivated after irrigation. If through pressure of work or other reasons cultivation cannot be performed as often as required, this reduction of caked surface means a corresponding reduction in loss by evaporation.

Basin Irrigation.—This method is very popular among South African fruit-growers, and consists of constructing small beds or basins around each tree with either a second small inner basin around the trunk of the tree or merely a mound thrown up to keep the water away from the stem. Water is then admitted to the outer basin. An objection to the basin system is the difficulty of cultivation by a horse-drawn implement of an orchard so irrigated.

Distribution by Checks.—This system consists of enclosing areas by low banks, and inundating each of these areas separately. The name is derived from the resemblance of a field, so laid out, to a checker board. In South Africa these checks usually go by the name of beds or "akkers."

There are several different modifications of the main system; the beds or checks may be laid out more or less rectangularly if the ground is nearly level, or they may be irregular, approximately following the contours of the land; the beds may be run in series of two rows in each with a furrow between each series, or they may be so arranged that the water runs from bed to bed in a zigzag course.

The disadvantage of this system is the cost of levelling the ground to prepare for the checks, but by this means a more uniform application is effected than can be done by any other means.

On gentle sloping uniform ground the beds are frequently only outlined by banks on two sides running down the steepest slope, the banks serving to keep the water within bounds. This modification of the check system is called the border system. Both this and the

contour banking system next described do not require as much levelling as the ordinary check method, and therefore are cheaper and do not cause the removal of so much surface soil and the consequent exposure of raw subsoil.

The checks may be formed by banking on the contours with about a foot fall between them; that is, when the water is just touching the top of the upper bank of the check, it will be standing a foot deep at the lower bank. The disadvantage of this system, as in the border system, lies in the non-uniformity of distribution. In the border system, especially in the long checks of a thousand yards which one sometimes comes across, the upper portion of the check is saturated before the water reaches the lower.

Similarly in the system of contour banking, the pressure of the water on the lower portion is greater than on the higher, and as a result the water sinks more deeply into the ground at the depressed edge of the bed. This disadvantage is to a certain extent diminished by the fact that with a crop of an extensive root system like lucerne the roots at the upper end of one bed derive a certain proportion of water from the lower end of the adjoining check.

In all the modifications of the check system the banks should be made of good height and with very wide basis, to allow for settling and trampling down. If the crop is to be lucerne, these broad, gentle sloping banks permit of mowers, etc., being run over them, and further, by being less liable to wear down, will not present the difficult problem of bank repair or renovation in a field of an established stand.

SOURCES OF SUPPLY.

Definitions.—For the purposes of this essay, all sources may be divided in flood schemes (not to be confused with distribution by flooding) and non-flood schemes. That is into those in which a large supply of water is available for a short period at irregular intervals, and those in which a smaller supply is available at all times or at such times as the irrigator himself may decide. The first includes all flood schemes such as are in working along our Karroo rivers; the second includes all schemes on perennial rivers (whether gravity or pumping schemes), storage schemes, and pumping from boreholes or wells. It is now proposed to examine the methods of distribution most applicable to these two different types of supply.

Flood schemes.—In flood schemes the most necessary feature demanded from a system of distribution is speed, and all systems except the check distribution fail to pass this test.

The checks, while bearing local conditions in mind, should be made as large as possible to take the large streams entailed by flood schemes.

The necessary sluices should be reduced in number as far as possible, easy to manipulate, and of a permanent character. This requires a considerable outlay of capital, but facilitates irrigation greatly, and its value is appreciated when a shortage of labour occurs or night watering becomes necessary.

The zigzag checks have been used with great success on flat ground where there is little chance of scour, and it is particularly to be recommended for night watering. Indeed, where other schemes are in use on a farm it is often advisable to lay out a portion of the lands in this manner to be set aside for irrigation done after dark. The

installation of the zigzag system cannot, however, be recommended for water carrying much silt, as the first bed acts as a settling basin, and the silt may unduly raise the level of the bed, or, possibly, in certain instances, ruin the soil.

Non-flood Scheme.—In non-flood schemes the irrigator is independent of the caprices of the river, and chooses his own time and period of irrigation. Speed here being of minor importance in distribution, other factors having a bearing on the subject can and must now be taken into account.

Distribution by flooding as applied to non-flood schemes is the cheapest and most rapid system to lay down, as little or no levelling is required; but it is an expensive system to manipulate owing to the difficulty of a single man handling any but a small stream in this manner.

The system of furrow distribution is the "nonpareil" method of irrigating orchards where a loose, porous soil is found, but non-porous soils cannot be watered in this way. A case illustrating this is on record where furrow distribution was employed in an orchard, the greater portion of which was loose and sandy, but one corner clayey. After each watering it was found that the sand was wet for considerably over two feet, while the clay for hardly that number of inches.

Basin irrigation is naturally only to be practised in tree culture, and is good for non-porous soils or for small orchards even with porous soils, but, as mentioned above, it presents obstacles to the cultivation of the surface and the formation of an effective mulch for the prevention of evaporation.

As basin irrigation is generally practised in South Africa, however, with small basins, and the water lying directly against the trunks of the trees, it is hardly too strong a condemnation of the method to say that it is worse than useless. An instance may be cited where intelligent dry-farming has been carried out in an orchard not ten yards from a fair sample of our ordinary basin irrigation, and with incomparably better results.

The check system can, of course, also be largely used for non-flood schemes, though the average size of the checks is naturally smaller than in the case of flood schemes, and can accordingly be more easily made to conform with the natural shape of the ground, thus reducing the cost. No guide as to the most efficient size can be given, as it varies with the amount of water available in the furrow and the porosity of the soil. The larger the stream the larger the check; the more porous the soil the smaller the check required to suit the case.

The border system is frequently employed, and for gentle-sloping, moderately porous soils it is to be recommended as a cheap and effective method if its size is kept within reasonable limits.

Non-porous soils should be watered by the ordinary check system, and the water be allowed to stand in the beds for as long a period as is possible without doing injury to the crop.

SLOPE OF LANDS.

The question of the slope of the land and its bearing on the distribution systems has been left over to be treated separately, as it would have complicated the subject unnecessarily to have introduced it at the same time with the question of soils, crops, and water supplies.

Very level lying lands are difficult to drain, and except in the case of very porous soils are apt to become swamped. Either flooding or the check systems of distribution may be employed, but the quantity of water supplied must be very carefully regulated to prevent drowning of the crops or water-logging of the soil.

In the hands of skilful men, when it is not desired to terrace on steep slopes, a flood distribution system with furrows close together is very useful except in the case of non-porous soils requiring too long a period of flooding. It is, however, a slow method of irrigating.

The main furrow feeding the minor furrows would, of course, be run down the steepest slope, and would require to be pitched or otherwise protected against scour. This would also apply to the feeders for the other forms of distribution, and can be eliminated from the discussion in the comparison of the different schemes.

On steep slopes, orchards may be so planted that the lines of the trees more or less follow the contours, and then the small distributory furrows run between these rows and described for average slopes. Vegetables on steep slopes may be treated similarly.

Basin irrigation and the check system can only be successfully carried out on steep ground after terracing.

CONCLUSION.

In conclusion, it must be borne in mind that the foregoing is little more than a summary of the factors entering into the problem of distribution. The question of cost, effective sizes of checks, etc., is so dependent on local conditions that it is impossible to deal with them in an essay of this length. It has been the endeavour in this discussion to show the advantages and disadvantages of the different methods as applied to certain extreme conditions. In South Africa, this country of samples, where so frequently half a dozen varieties of soil are found on one farm, straightforward problems in distribution are not very common; but the close observation of local conditions and a careful study of the main principles as outlined above will enable the irrigator to put down a good distributary system on his farm. In so far as the local conditions form more or less complicated combinations of the extreme conditions dealt with, correspondingly complicated combinations of the main methods of distribution will have to be employed.

Three general points suggested throughout this discussion may here be rementioned as points applicable to all problems which may arise:—

(1) Distribution by rule of thumb is impossible. The system most suitable to one farm may not be the best for the adjoining farm where local conditions are different.

(2) Irrigation without subsequent cultivation to produce an effective mulch is like carrying milk in leaky pails—there is too much waste.

(3) As soon as the local conditions are thoroughly understood one general scheme of distribution for the whole farm should be designed, and if possible marked down on the ground; so that no matter over what period the work is spread, or in which order it is done, the whole will hang together and not cause subsequent large expenditure in order to alter existing works in joining up the separate parts.

Commercial Valuation of Government Guano.

By Dr. C. F. Juritz, Chief Chemist, Cape Province.

In the December issue of this journal a list was given of the previous season's fertilizers registered under the Cape Province Fertilizers and Farm Foods Act, and of the chemical composition of each fertilizer. A record of the *total* amount of the constituents of a fertilizer is not always a sufficient indication of its value, for the values of those constituents are different if their origin differs. Thus nitrogen derived from blood is much more valuable than nitrogen derived from horns; potash in the form of ground phonolite is bound to command a different price from what it does when in the form of high-grade sulphate; an insoluble rock phosphate would certainly not be valued as highly as a water soluble phosphate, in the form of superphosphate for example. So an anlysis of one fertilizer may show that most of its nitrogen is present as nitrate or as ammonia; of another fertilizer it may show that all its nitrogen exists as a relatively insoluble organic compound; the former, supposing the percentages of nitrogen in the two fertilizers to be equal, would be the more valuable of the two articles.

Yet it must not be forgotten that while the *agricultural* value of a fertilizer depends on the character of the materials whereof it is composed, the *commercial* value of a fertilizer is quite distinct from this and for any particular locality depends wholly upon the local market price of the materials, and although that market price may sometimes depend upon the demand for materials which are agriculturally of the greatest value, it may also be ruled by circumstances wholly different, so that a fertilizer relatively highly valuable to the agriculturist—if used with proper circumspection—may be obtainable at so low a price that he may be tempted to apply it without any circumspection at all.

In order to ascertain whether a complete fertilizer or a mixture of different ingredients is being offered for sale at a price reasonably approximate to its actual market value, it is necessary to know the market value, at the point of supply, of its several plant-food ingredients taken singly. That point of supply may be a port, such as Capetown or East London, or it may be far inland where the railage on each ingredient will give the mixture a higher market value. In the following calculations the point of supply is uniformly taken to be Capetown. At other ports the values may be higher or lower. At Durban, for instance, unit values were, generally speaking, decidedly lower four years ago than they then were at Capetown. Briefly, we may put it that the commercial value of a mixed fertilizer is the sum of the values of its ingredients plus the cost of mixing, so that if we wish to know the commercial value of a ton of any given fertilizer all that we need to do is to multiply the unit value (i.e. the value of 20 lb.) of each constituent by percentage of that constituent in the mixture and add the various products together, increasing the sum by a small amount like 5s. to cover the cost of mixing.

The selling prices per ton for various fertilizers in Capetown are as follows:—

		£	s.	d.
1.	Nitrate of soda (nitrogen = 15.5 per cent.)	£14	0	0
2.	Nitrate of soda (nitrogen = 15.0 per cent.)	14	10	0
3.	Nitrate of soda (nitrogen = 15.0 per cent.)	12	10	0
4.	Sulphate of ammonia (nitrogen = 19.8 per cent.)	16	0	0
5.	Sulphate of ammonia (nitrogen = 20.0 per cent.)	22	10	0
6.	Sulphate of ammonia (nitrogen = 20.5 per cent.)	16	0	0
7.	Sulphate of potash (potash = 48.0 per cent.)	13	10	0
8.	Sulphate of potash (potash = 48.6 per cent.)	13	10	0
9.	Sulphate of potash (potash = 48.0 per cent.)	13	10	0
10.	High-grade sulphate of potash (potash = 51.8 per cent.)	14	0	0
11.	High-grade sulphate of potash (potash = 51.0 per cent.)	14	0	0
12.	Muriate of potash (potash = 51.0 per cent.)	11	10	0
13.	Muriate of potash (potash = 50.8 per cent.)	11	10	0
14.	Muriate of potash (potash = 50.0 per cent.)	11	10	0
15.	High-grade muriate of potash (potash = 60.3 per cent.)	12	10	0
16.	High-grade muriate of potash (potash = 60.0 per cent.)	13	10	0
17.	Burnt lime (lime = 98.0 per cent.)	2	0	0
18.	Gypsum (lime = 34.0 per cent.)	4	0	0

If in each case the sale price is divided by the percentage of the active ingredient the following unit values (i.e. the value of 20 lb., or 1 per cent. of the fertilizing ingredient) are arrived at for the eighteen lots of fertilizers in the above list:

		£	s.	d.
1.	Unit value of nitrogen =	£0	18	1
2.	Unit value of nitrogen =	0	19	4
3.	Unit value of nitrogen =	0	16	8
4.	Unit value of nitrogen =	0	16	2
5.	Unit value of nitrogen =	1	2	6
6.	Unit value of nitrogen =	0	15	7
7.	Unit value of potash =	0	5	7
8.	Unit value of potash =	0	5	7
9.	Unit value of potash =	0	5	7
10.	Unit value of potash =	0	5	5
11.	Unit value of potash =	0	5	6
12.	Unit value of potash =	0	4	6
13.	Unit value of potash =	0	4	6
14.	Unit value of potash =	0	4	7
15.	Unit value of potash =	0	4	2
16.	Unit value of potash =	0	4	6
17.	Unit value of lime =	0	0	5
18.	Unit value of lime =	0	2	4

The mean unit values are therefore as shown below. For comparison I add the corresponding unit values calculated in 1909 from prices then current.

	1913.	1909.
Nitrogen		
in nitrates	£0 18 0	£1 2 7
in sulphate of ammonia	0 18 1	1 5 0
Potash		
in sulphate	0 5 7	0 6 8
in high-grade sulphate	0 5 5½	—
in muriate	0 4 6	—
in high-grade muriate	0 4 4	—
in kainit	—	0 10 5

Lime	1913.	1909.
in burnt lime...	0 0 5	0 0 5½
in gypsum...	0 2 4	—

The above calculations afford a fair idea of the present unit values of nitrogen, potash, and lime. In order to obtain similar values for phosphoric oxide more complicated calculations are necessary, and in the first place the market prices of phosphatic fertilizers have to be considered. Here the following data are available:—

19. High-grade superphosphate (phosphoric oxide citrate soluble = 17.5 per cent., lime = 23.0 per cent.) ...	£3 15 0
20. High-grade superphosphate (phosphoric oxide citrate soluble = 18.0 per cent., lime = 25.0 per cent.) ...	3 15 0
21. High-grade superphosphate (phosphoric oxide citrate soluble = 17.5 per cent., lime = 23.0 per cent.) ...	3 17 6
22. Basic slag (phosphoric oxide citric acid soluble = 14.0 per cent., total phosphoric oxide = 17.0 per cent., lime = 45.0 per cent.)	3 10 0
23. Basic slag (phosphoric oxide citric acid soluble = 13.5 per cent., total phosphoric oxide = 16.5 per cent., lime = 47.0 per cent.)	3 7 6
24. Basic slag (phosphoric oxide citric acid soluble = 14.4 per cent., total phosphoric oxide = 18.0 per cent., lime = 42.0 per cent.)	3 7 6
25. Bone meal (phosphoric oxide citrate soluble = 13.0 per cent., total phosphoric oxide = 21.0 per cent., nitrogen = 3.4 per cent., lime = 28.0 per cent.)...	6 10 0
26. Whale bone meal (phosphoric oxide citrate soluble = 8.4 per cent., total phosphoric oxide = 27.0 per cent., nitrogen = 3.5 per cent., lime = 30.0 per cent.)	6 0 0
27. Bone meal (phosphoric oxide citrate soluble = 13.0 per cent., total phosphoric oxide = 20.0 per cent., nitrogen = 3.5 per cent., lime = 25.0 per cent.)...	6 10 0
28. Whale bone meal (phosphoric oxide citrate soluble = 12.2 per cent., total phosphoric oxide = 25.0 per cent., nitrogen = 2.5 per cent., lime = 37.7 per cent.)	5 0 0

With 5d. as the unit value of lime the percentages of lime in the superphosphates and basic slags will be valued as follows:—

19. 5d. × 23 =	£0	9	7
20. 5d. × 25 =	0	10	5
21. 5d. × 23 =	0	9	7
22. 5d. × 45 =	0	18	9
23. 5d. × 47 =	0	19	7
24. 5d. × 42 =	0	17	6

Hence (disregarding the insoluble phosphoric oxide in the basic slags) the soluble phosphoric oxide in those six fertilizers will have the following values:—

					s.	d.				
19.	£3	15	0	less	9	7 =	£3	5	5
20.	£3	15	0	less	10	5 =	3	4	7
21.	£3	17	6	less	9	7 =	3	7	11
22.	£3	10	0	less	18	9 =	2	11	3
23.	£3	7	6	less	19	7 =	2	7	11
24.	£3	7	6	less	17	6 =	2	10	0

Dividing these values by the respective percentages of soluble phosphoric oxide the following unit values are obtained:—

19. Unit values of soluble phosphoric oxide ...	£0	3	9
20. Unit values of soluble phosphoric oxide ...	0	3	7
21. Unit values of soluble phosphoric oxide ...	0	3	11
22. Unit values of soluble phosphoric oxide ...	0	3	8
23. Unit values of soluble phosphoric oxide ...	0	2	11
24. Unit values of soluble phosphoric oxide ...	0	3	6

And so the mean unit value for citrate soluble phosphoric oxide in superphosphates may be taken as 3s. 9d., and that of the soluble phosphoric oxide in basic slag as 3s. 4d.

"In dealing with mixed fertilizers," says A. D. Hall ("Fertilizers and Manures," p. 344), "the nitrogen is generally the most important element to consider, as being the most valuable and the most subject to variations in price."

For that reason the cost of nitrogen in such a complete fertilizer is ascertained by deducting from the selling price of the fertilizer the value of the lime, potash, and phosphoric oxide which it contains, the balance being, of course, the cost of the nitrogen.

Thus the bone meals Nos. 25 to 28 may be dealt with, taking the finely ground bone phosphate as 9d. per unit less in value than that in superphosphate.

Bone Meal, No. 25—

Phosphoric oxide, 21 per cent. at 3s. ...	=	£3	3	0
Lime, 28 per cent. at 5d.	=	0	11	8
		3	14	8
Residual value = nitrogen (3.4 per cent.)	=	2	15	4
		£6	10	0

Whale Bone Meal, No. 26—

Phosphoric oxide, 27 per cent. at 3s. ...	=	£4	1	0
Lime, 30 per cent. at 5d.	=	0	12	6
		4	13	6
Residual value = nitrogen (3.5 per cent.)	=	1	6	6
		£6	0	0

Bone Meal, No. 27—

Phosphoric oxide, 20 per cent. at 3s. ...		£3	0	0
Lime, 25 per cent. at 5d.	=	0	10	5
		£3	10	5
Residual value = nitrogen (3.5 per cent.)	=	2	19	7
		£6	10	0

Whale Bone Meal, No. 28—

Phosphoric oxide, 25 per cent. at 3s. ...	=	£3	15	0
Lime, 37.7 per cent. at 5d.	=	0	15	9
		4	10	9
Residual value = nitrogen (2.5 per cent.)	=	0	9	3
		£5	0	0

In these bone meals, upon the basis of the above calculations, the unit values for nitrogen come out as follows:—

25.	£2	15	4 ÷ 3.4	=	£0	16	3
26.	£1	6	6 ÷ 3.5	=	0	7	4
27.	£2	19	7 ÷ 3.5	=	0	17	0
28.	£0	9	3 ÷ 2.5	=	0	3	8

Excluding the whale bones, Nos. 26 and 28, for which there is apparently not yet a sufficient demand to render them the basis of fair calculation, the other two bone meals give a mean unit value for nitrogen of 16s. 8d.

In the light of the above calculations the commercial valuation of Government guano may now be considered. The selling price of the guano is fixed at £5 per ton, at which price the demand is invariably far greater than the supply. The composition of the guano is given in the following analyses made at various times during 1912:—

No.	Date of Report.	Nitrogen.	Lime.	Potash.	Phosphoric Oxide. Water soluble.	Phosphoric Oxide. Citrate soluble.	Phosphoric Oxide. Total.
		%	%	%	%	%	%
29	29th January	12·18	8·68	2·41	3·78	9·05	9·24
30	17th February	12·22	7·87	2·32	3·51	7·87	7·87
31	6th March ...	13·68	8·94	2·61	3·33	9·24	9·24
32	20th March ...	6·82	15·52	1·73	2·92	12·72	15·42
33	20th March ...	10·50	14·61	2·30	2·79	13·95	14·62
34	24th April ...	12·60	9·96	1·98	3·77	8·33	10·45
35	4th June ...	10·54	7·09	1·25	2·91	7·50	7·54
36	10th June ..	13·96	9·02	3·85	2·54	9·22	9·32
37	17th June ...	10·85	9·01	3·30	3·07	8·30	8·48
38	17th July .	12·46	10·14	1·87	3·15	8·54	8·54
39	9th August ...	9·24	12·10	1·53	4·12	11·66	12·04
40	15th August ...	9·66	10·31	1·63	3·64	8·92	9·30
41	9th October ...	10·29	8·19	1·37	2·39	8·45	8·81

In order to show the low rates at which nitrogen can be purchased in the form of guano, the residual values of nitrogen in a ton of each of these guanos may be calculated in the same way as for the bone meals (Nos. 25 to 28) after allowing for potash and phosphoric oxide, taking potash at its lowest unit value of 4s. 4d., but valuing the soluble phosphoric oxide on the same scale as for basic slags.

No.	29.	30.	31.	32.	33.	34.	35.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soluble phosphoric Oxide	1 10 2	1 6 3	1 10 10	2 2 5	2 6 5	1 7 9	1 5 0
Lime	0 3 7	0 3 3	0 3 9	0 6 6	0 6 1	0 4 2	0 2 11
Potash	0 10 5	0 10 1	0 11 4	0 7 6	0 10 0	0 8 7	0 5 5
	2 4 2	1 19 2	2 5 11	2 16 5	3 2 6	2 0 6	1 13 4
Residual Value = Nitrogen	2 15 10	3 0 5	2 14 1	2 3 7	1 17 6	2 19 6	3 6 8
Sale Price ...	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0

(continued)

No.	36.	37.	38.	39.	40.	41.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soluble Phosphoric Oxide	1 10 9	1 7 8	1 8 6	1 18 10	1 9 9	1 8 2
Lime	0 3 9	0 3 9	0 4 3	0 5 1	0 4 4	0 3 5
Potash	0 16 8	0 14 4	0 8 1	0 6 8	0 7 1	0 5 11
	2 11 2	2 5 9	2 0 10	2 10 7	2 1 2	1 17 6
Residual Value = Nitrogen	2 8 10	2 14 3	2 19 2	2 9 5	2 18 10	3 2 6
Sale Price ...	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0

Working out the calculation on the basis of the residual values of nitrogen in the above table, the cost of nitrogen to the purchaser (i.e. its unit value) in these nine samples of guano is arrived at by dividing the residual values by the percentage of nitrogen, and so the following figures are obtained:—

No. 29	£0	4	7
No. 30	0	4	11
No. 31	0	4	0
No. 32	0	6	5
No. 33	0	5	6
No. 34	0	4	9
No. 35	0	6	4
No. 36	0	3	6
No. 37	0	5	0
No. 38	0	4	9
No. 39	0	5	4
No. 40	0	6	1
No. 41	0	6	1

The mean unit value for nitrogen in guano is therefore 5s. 2d.—very considerably lower than in any other fertilizer in common use. So it is plain that Government guano affords an exceedingly cheap source of nitrogen for manurial purposes.

To put the matter in another way, if the nitrogen in the guano were valued at an even lower rate than in bone meal (i.e. 16s. per unit) and added to the values of phosphoric oxide, lime, and potash in the foregoing table, instead of regarding the nitrogen as residual after deducting the values of the other constituents, the valuation of the guano would be far above £5 per ton, as the following table shows:—

No.	29.	30.	31.	32.	33.	34.	35.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Soluble Phosphoric Oxide	1 10 2	1 6 3	1 10 10	2 2 5	2 6 5	1 7 9	1 5 0
Lime	0 3 7	0 3 3	0 3 9	0 6 6	0 6 1	0 4 2	0 2 11
Potash	0 10 5	0 10 1	0 11 4	0 7 6	0 10 0	0 8 7	0 5 5
Nitrogen ...	9 14 10	9 15 6	11 4 11	5 9 1	8 8 0	10 1 7	8 8 7
Total commercial value of Guano per ton	11 19 0	11 15 1	13 10 10	8 5 6	11 10 6	12 2 1	10 1 11

(continued)

No.	36.			37.			38.			39.			40.			41.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Soluble Phosphoric Oxide	1	10	9	1	7	8	1	8	6	1	18	10	1	9	9	1	8	2
Lime	0	3	9	0	3	9	0	4	3	0	5	1	0	4	4	0	3	5
Potash	0	16	8	0	14	4	0	8	1	0	6	8	0	7	1	0	5	11
Nitrogen ...	11	3	4	8	13	7	9	19	4	7	7	10	7	14	6	8	4	7
Total commercial value of Guano per ton	13	15	6	10	19	4	12	0	2	9	18	5	9	15	8	10	2	1

The mean commercial value per ton of these guanos would, upon this basis, be £11. 4s. 4d., or £6. 4s. 4d. per ton above its present sale price.

The above calculations must not be taken as indicating absolutely the commercial values of the guanos to which they are applied, and even some of the unit values, for instance of phosphoric oxide in its different degrees of solubility, must be regarded as only approximate. Data on which to found these calculations are as yet scanty, and information as to the market values of the components is supplied at present from too restricted a source to be sufficiently comprehensive for more reliable calculations. It should, nevertheless, be the aim as soon as possible to place before merchants and others a system of unit values from which the worth of fertilizers at all the chief centres could be estimated. In support of such a system it may be said, in the words of the late Professor E. B. Voorhees, of New Jersey, that* "it is a system which more nearly approaches perfection than any other that has been devised, is educative in its tendency, and is a safe guide in the majority of instances as to the charges made for mixing, handling, and selling plant food contained in the different brands. If the analysis is properly interpreted it is the purchaser's fault if he buys poor forms of plant food at a high price. It is certainly a safer guide than mere name of brand, and does not encourage the use of poor materials."

The unit values arrived at and employed as the basis of calculation in this discussion are as follows:—

	£	s.	d.
Nitrogen			
in nitrates	£0	18	0
in ammonia salts	0	18	1
in bone meal	0	16	8
in guano	0	5	2
Potash			
in sulphate	0	5	7
in high-grade sulphate	0	5	5½
in muriate	0	4	6
in high-grade muriate	0	4	4
in guano	0	4	4
Lime			
in burnt lime or bone meal	0	0	5
in gypsum	0	2	4

* "Fertilizers," p. 161.

Phosphoric oxide:			
Water or citrate soluble, in superphosphates...	0	3	9
Citrate soluble in guano ...	0	3	4
Citric acid soluble, in basic slag ...	0	3	4
In bone meal ...	0	3	0

In conclusion, readers must again be asked not to infer from these unit values that the nitrogen in Government guano is *worth* only 5s. 2d. per unit. It is, as already shown, worth considerably more than that, but the above unit value is merely an approximate indication of the price that local purchasers have to pay for so valuable a fertilizing constituent as nitrogen.

Windbreaks for the Dry Farm.

By K. A. CARLSON, Conservator of Forests, Orange Free State.

THE introduction of forestry in the Free State within the last decade has played no mean part in developing proper methods of dry cultivation and in illustrating their importance and beneficial results. Whereas in many parts the Free State farmer formerly considered it a natural law that no trees could grow on dry land without artificial watering, many millions of trees are at the present day established entirely by dry cultivation in this Province.

Typical conditions for dry farming may—shortly stated—be said to obtain in situations with a sandy or loamy surface soil of fair depth, resting on a deep moisture-retaining sub-soil, and with a limited rainfall, unfavourably distributed in relation to cropping seasons. The minimum amount of rain necessary for dry-farming cannot be stated in general terms. It depends on other local factors, such as nature and depth of soil, aspect, winds, temperature, and humidity of the air, all of which have a bearing on rate of evaporation. Under dry farming is included every method by which unseasonable rains can be stored and conserved in the soil until required, and then its utilization with economy and smallest amount of waste for the production of crops.

The storing of rainfall in the soil is a comparatively simple method effected by deep ploughing so as to store the greatest amount of rain possible. Once this has been absorbed it is equally simple to conserve the moisture by means of shallow cultivation, which prevents loss by transpiration and evaporation, until such time as required for the development of crops.

Of the factors that influence wasteful evaporation wind is by far the most active. Although wind has very little direct effect on evaporation from clean ground covered by a layer of dust or mulch, it acts harmfully (*a*) by blowing away this covering and exposing the

moist soil below to its drying influence; and (*b*) by carrying off the moisture that enters the air through evaporation. But it is after the crop is in the ground that wind does the greatest amount of damage on the dry farm, on account of its desiccating effect on growing vegetation, and to prevent this is an urgent necessity. Transpiration of moisture through the leaves of plants is a necessary function of growth, but is only required to a moderate extent. When this process is accelerated by the action of wind it becomes excessive and injurious to plants in proportion to the strength of the wind. This effect can be readily ascertained by noting the difference in growth of succulent plants when exposed to wind as compared with those in sheltered situations.

Trees afford the only satisfactory means by which efficient windbreaks can be constructed. When a strong air-current strikes a solid obstruction, such as a wall, it merely turns a somersault over it, and descends again a short distance beyond. When it encounters a belt of trees part of the wind filters gently through the foliage, whereby its force is gradually checked, with the result that a more or less stationary air-cushion is created for some distance on the windward side of the belt, causing the wind coming on behind to be deflected upwards and to pass over the trees. In the same manner the wind that filters through the foliage of the belt forms a similar air-cushion on its leeward side, preventing the strong current above from descending too rapidly. The protection thus afforded by an efficient windbreak has been ascertained to amount to five times its height on the windward side and fifteen to twenty times its height on the leeward side. That is to say, a belt 50 feet high, running at right angles to the prevailing wind, would afford protection for a distance of 1000 to 1250 feet.

By an efficient windbreak must be understood one of sufficient height and density to afford effective shelter for the particular region and purpose for which shelter is desired. An inefficient windbreak is worse than none at all, because it consumes moisture without conserving any. Hence it is of the greatest importance to avoid haphazard tree-planting on the dry farm. Every situation should be carefully studied before the form and composition of a windbreak is decided upon. When it is remembered that every kind of tree has its distinct likes and dislikes as to the nature of the locality in which it will thrive, and that trees are the most permanent things on a farm, the need for care and forethought will be readily understood.

To decide on the choice of trees and form of belt suited to different combinations of circumstances naturally requires a great deal of knowledge and experience which few farmers have had the opportunity to gain. They should therefore apply to the Forest Department for advice before doing so. What may be an efficient windbreak in one set of circumstances may be quite inefficient in another. In some cases a single row of trees will suffice, in others a belt, ten, twenty, and thirty yards wide, is essential. In some circumstances it is better to use one kind of tree only, in others a combination of two or more kinds is necessary. Height growth of trees varies considerably, not only between different kinds, but in a single variety, according to the soil and situation. Rate and density of growth is very variable in different species, and has, together with the object in view, to be taken into account when deciding what espacement to adopt.

While thus sounding a note of warning against thoughtless planting I cannot too strongly urge the necessity for properly planned

windbreaks on the dry farm. I go so far as to say that without such windbreaks dry-land cultivation over very large tracts in the Free State and neighbouring Provinces may result in ruination of the land.

I have already mentioned the danger of wind blowing away the dry layer of earth required as a mulch to prevent evaporation. Over extensive areas of the most suitable parts for dry-land cultivation, especially in the midland, northern, and western parts of the Free State, the soil is a fairly deep sandy loam, resting on a more or less clayey sub-soil. These conditions are most favourable, both for absorbing and storing the rainfall in the soil. But, unless protected by windbreaks, cultivated lands in such localities may, in a season or two, be converted into drifting masses of sand, not only rendering the original part useless for further cultivation, but destroying all vegetation on adjoining areas to the leeward, the soil on which, after a time, also starts drifting until the evil becomes almost uncontrollable and the country is reduced to semi-desert conditions.

Many instances in the country can be pointed out to prove the reality of this danger. Three years ago I examined a spot on the left bank of the Vaal River, which had lost the protection of its natural tree growth, and the grass had been destroyed by cattle going to the river to drink. When the danger was first realized by the farmer he put a fence round the sand-drift to keep stock away, but it was too late, and in two years' time the sand had advanced and destroyed the vegetation for a distance of 300 yards beyond the fence. The total area by then rendered useless covered a tract of 400 by 1000 yards—over 80 acres in extent.

On another part of the farm a land was ploughed and sown with wheat. An excellent crop was reaped, but further cultivation had to be abandoned because the soil started blowing away. Fortunately the grass got a hold again, but another season's cultivation would have created an irrevocable sand-drift here also.

In another instance in the southern part of the Free State a 30-acre land was cropped for three years. The third year the soil began to drift and no crop was reaped that season. Since then the land had to be abandoned, and when I saw it two years later the soil blown off the original area had wholly or partially destroyed the grass over another 80 acres. Thus in five years about 100 acres of the farm were completely destroyed and a great deal more threatened.

These are not isolated cases, for I have seen many others on a smaller scale, but they are sufficient to indicate the danger ahead. Instead of spreading waste and ruin these same lands, if properly protected by a comprehensive system of efficient windbreaks, would have been capable of producing first-class crops in perpetuity under proper methods of dry-land cultivation.

Apart from the danger above referred to, our climatic conditions are such that a full crop can only be expected in about one year of every five. During the remaining four it is either a partial or a total failure. By establishing windbreaks it is possible to convert seasons of half crops to practically full crops and total failures to anything up to half crops. Whether we take a crop of wheat or mealies the most critical period it has to pass through is during the season of continuous dry winds in spring, before the heavy summer rains set in. Even when good showers do fall at this time they are of very little use, being re-evaporated by the dry winds before the crops have had time to utilize the moisture. A few days of desiccating wind is often

sufficient to destroy a wheat crop which for months past has given great promise of a good harvest. How often does it not happen that our mealie lands have to be resown two or three times on account of dry winds destroying the tender young plants soon after they appear? And, after all, when a young crop is at last established the season is probably too far advanced to allow the grain to mature before frost sets in. All this can be avoided by having windbreaks.

In calculating the real value of windbreaks there are many points to take into consideration, both for and against. The points in favour are:—

1. Economy of soil moisture due to prevention of excessive transpiration by crops and grass.
2. Protection against damage to plants by the mechanical force of wind.
3. Protection of cultivated and adjoining lands against soil drifting and danger of total destruction.
4. Production of timber for economic uses on the farm.

Against these have to be set the following disadvantages:—

1. Loss of soil moisture by root-sapping and transpiration of the trees.
2. Loss of crops by shading a strip of ground adjoining the belt.
3. Loss of space for crops on the ground occupied by the trees.

The last of these losses is more than compensated for by the return of timber and by the increased yield of crops in the protected area. The loss from shading can be minimized in two ways—either by utilizing the space for roads or, if there is sufficient moisture close to the trees, by growing fodder crops that are not required to produce grain, as only grain crops are sensitive to shading. The loss of soil moisture by root-sapping and transpiration which only takes place within a limited distance from the belt, is compensated for many times over by checking evaporation over the rest of the protected area.

To enter into a full discussion of the individual values of the pros and cons would take a long time and involve much technical matter. Suffice it to say that the Americans, who never consider any trouble too great if there is a profit sticking out at the end of it, have conducted extensive investigations on this subject, and have arrived at the conclusion that windbreaks are a very paying proposition.

Besides field crops, windbreaks are required for the following purposes:—

1. For orchards, to protect the blossom from cold winds, and to conserve the soil moisture and protect the fruit against hot winds.
2. For stock. If stock is protected against cold winds it requires far less feeding in winter and spring than if exposed.
3. For dams. Windbreaks to dams in an open country effect a great saving of storage water during the time of prevailing winds.
4. Buildings, homesteads, and gardens need protection against duststorms and cold blizzards in order that our homes and surroundings may be made comfortable and beautiful,

In Europe it is estimated that 20 per cent. of every farm should be covered by shelter woods. Let us begin modestly in South Africa and resolve that at least 3 to 5 per cent. shall be judiciously planted.

In conclusion, let me again urge you not to neglect planting windbreaks, but take care that they are of the efficient kind.

The following is a rough statement of trees suitable for windbreaks in the Free State, but it must be distinctly understood that the selection of kinds and of the form and composition of belts, etc., depends entirely on the conditions of each locality, and that these may vary to a very great extent on a single farm, and even on different sides of a small field:—

TREES SUITABLE FOR WINDBREAKS IN THE FREE STATE.

(*a*) From 70 to 100 feet high. Not dense except in youth. Suitable for wide belts for protection to large camps. Of quick growth and producing rough timber and fuel.

Gums: *Eucalyptus amygdalina.*
,, *gunnii.*
,, *viminalis.*

Near cultivated lands these gums should be flanked by cypresses or pines to minimize root-sapping, the width of belt occupied by the gums being reduced according to circumstances governing the case.

(*b*) From 40 to 70 feet high. Not dense except in youth. Same remarks as under (*a*), except that their timber is not quite so fast growing but much more durable.

Gums: *Eucalyptus rostrata.*
,, *sideroxylon.*
,, *tereticornis.*

(*c*) From 40 to 70 feet high. Dense in youth and fairly dense later.

Gums: *Eucalyptus melliodora.*
,, *polyanthemos.*
,, *stuartiana.*
Pines: *Pinus halepensis.*
,, *insignis.*
,, *pinaster.*

The melliodora and polyanthemos gums yield excellent timber, very strong and durable. Stuartiana timber is poor. The pines retain their density much longer than the gums, and their timber, if grown closely to prevent knots, is suitable for same purposes as deals.

(*d*) From 40 to 70 feet high. Very dense shelter which is maintained throughout.

Cypresses: *Cupressus arizonica.*
,, *guadalupensis.*
,, *lusitanica.*
,, *macrocarpa.*
,, *horizontalis.*
Juniper: *Juniperus virginiana* (very slow).

Those timbers are soft, but durable, and of excellent quality for many purposes. Must be grown closely to be free from knots.

(e) From 20 to 30 feet high. Fairly dense. Suitable for shade trees to protect stock against hot sun. Also suitable as flanking rows to belts of tall gums, which by themselves become too open below.

Wattles: *Acacia dealbata.*
,, *normalis.*
Gums: *Eucalyptus coriacea* (var. *alpina*).
Karreeboom: *Rhus lancea.*
Pepper tree: *Schinus molle.*
Except the pepper tree all these make good poles.

The Preservation and Use of Maize for Stock Feed.

By JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

(Continued from Page 592.)

MAIZE FOR HORSES.

NEXT to oats, maize is the common grain for horses in America, being used most largely in the southern portion of the corn-belt and southward in the cotton States. While conceding that maize is not the equal of oats as a grain for the horse, Henry concludes that, because of its low cost and high feeding value, it will be extensively used where large numbers of horses must be economically maintained.

Maize may be fed whole to horses, but generally it is made fine by grinding, and mixed with various other concentrates. Maize and cob meal is preferable to pure maize meal. Maize meal alone is a sodden substance in the animal's stomach, and should be diluted or extended with something of a light character, such as bran, which is light and cool in effect and furnishes protein and mineral matter.

"Maize contains a high proportion of digestible carbohydrates, and tends to make the animals fat and liable to sweat; while it improves their appearance, it somewhat detracts from their physical energy." (Lehmann, quoted by Wolff, *Farm Foods*, Engl. Ed., p. 246.)

Henry quotes the maize feeding experiment of the Paris Omnibus Company, employing nearly 10,000 horses. The conclusions reached were that "a mixture of 6.6 lb. of maize and 12.1 lb. of oats will prove the most satisfactory for work-horses, the ratio varying in each case according to the temperament of the animal. Compared with the time when only oats were fed, they are more calm at the present and lack the former abundance of vivacity; but, on the other hand,

work as well and as rapidly as before." The company saved about 38s. 7d. per horse during 1876 by the partial substitution of maize for oats. (See also Journ. de l'Agric., 1877, p. 127; Biederm. Centrabl., 1877, p. 255.)

Further experiments with maize feeding were conducted by Muntz in 1881 with 362 horses belonging to the Paris Omnibus Company. With a daily ration of—

Maize...	6.7 lb.
Oats	9.5 ,,
Beans...	2.1 ,,
Bran	1.1 ,,
Hay	10.4 ,,
Straw	11.0 ,,
	40.8 ,,

the average weight of the horses remained the same during the experiment and the amount of work done did not change, showing that the ration met the requirements of the animals.

In a second test the following ration was used:—

Maize	9.7 lb.
Oats...	6.8 ,,
Beans	3.3 ,,
Bran	0.9 ,,
Hay	6.6 ,,
Straw	13.2 ,,
	40.5 ,,

On this ration, not only did the animals continue to work as before, but also gained in weight.

In these experiments it was found that maize is best if crushed before feeding to horses, and if crushed with the cobs left in. "Corn and cob meal is considered a better feed than pure corn meal on account of its higher content of cellulose, which renders it more like oats. Thirty per cent. of an oat ration may be replaced by maize and cob meal." Similar reports as to the availability of maize for horse feeding are published in regard to the Berlin Street Car Company (Nordd. Landw., 1881, p. 141; Biederm. Centralbl., 1881, p. 768), the Berlin mail-horse stables (Landw. Blatt. f. Oldenburg, 1880, p. 180), and the New York Omnibus Co. (Thur. Ldw. Zeit, 1880, p. 16); see also the exhaustive report on the subject by Bruckmuller on experiments conducted with army horses under the auspices of the Austrian Government in Oest. Viertelj. f. Wiss. Vet. Kunde, 49 (1878), p. 1; Biederm. Centralbl., 1878, p. 420.

The Utah Station (Bull. 30) found that horses fed maize and timothy hay did as well as those fed oats, clover, and timothy hay. Also (Bull. 36) that maize sustained the weight of horses better than oats.

On the other hand it is stated (Fühling's *Landw. Zeitung* 39, 1890, p. 63) that the stockholders of the London Omnibus Company objected to the intensive feeding of maize to the horses of the company

"because the mortality had increased with the extensive feeding of maize, and the horses seemed to wear out much sooner." The horses fattened by the maize feeding, but the muscular system was not kept strong, and the nervous force of the animals decreased, as a result of which the veterinarian was oftener consulted than before the extensive use of maize began. Similar experiences were reported in the case of the street-car horses of Berlin (Jahrb. Agrl. Ch., 1890, p. 641). (*Henry.*)

In Germany, Dr. Kloepfer (1895), quoted by Henry, draws the following conclusions (Biederm. Centralbl., 1895, p. 275) from investigations conducted by himself and others concerning the value of Indian corn as a food for horses: "Maize is well adapted to replace oats, since the chemical composition of both cereals, especially as regards protein and fat, are nearly the same. The whole-grain feed may be made up of maize in winter time, and three-fourths of it in summer time. Five pounds of maize are equivalent to six pounds of oats. The heaviest feed should be given at night. The change from oats to maize feed should occur very gradually, the transition period lasting from two to four weeks according to the extent to which the oats are to be fed in connection with the maize. *New maize should not be fed to horses.* The American dent varieties of maize are the best adapted to horse feeding." (*Henry.*)

Settegast (Thierzucht II, 110) concludes that, while among all cereals oats are the best adapted for horses, and can hardly be replaced for colt raising, maize may be considered as approximating oats in value for work horses. "Experiments have shown that a ration of 18.7 lb. maize and 11 lb. of straw is profitable for omnibus horses. Maize is best suited to animals at plain steady work. Its supply should be limited with colts and growing horses because of its lack of ash and protein." (*Henry.*)

MAIZE FOR SHEEP.

During the last twenty-five years a new industry has sprung up in the Western United States—that of fattening "plains" sheep in the maize-belt In the winter of 1889-90, 625,000 head of plains sheep were fattened in the State of Nebraska alone, the great maize crop of that year forming the basis of operations (U.S.D.A. Special Report on the Sheep Industry, pp. 845-94). The system is described briefly as follows: "During the summer, plains sheep purchased in New Mexico, Colorado, or other western ranges, are gradually moved eastward, grazing as they go. . . . By the time the maize is ripe the sheep have reached some point where it is for sale in vast quantities and at a low price. A corral or enclosure is made of pickets, and into this the sheep are driven, to remain until fattened. . . . Often 20,000 to 30,000, divided into a few bunches, are fed at a single point. Wild hay (i.e. veld hay) is unloaded against the picket fence through which the sheep feed. The only labour in handling the hay after unloading is for an attendant to keep it moved up close to the fence. From one and a half to two bushels of maize (84 to 112 lb.), fed in troughs, are required per day for 100 head of sheep. To this is usually added a few pounds of oil meal (linseed or cotton seed). The feeding continues about 100 days, the sheep gaining on an average 15 lb. per head during that time. The profit comes mainly from increasing the original value of the sheep. The

industry is an irregular and uncertain one. . . . The profit depends upon the price of maize, which varies greatly from year to year and cannot be foretold much in advance of the time for feeding. Large numbers of Montana sheep are fed in much the same manner in Minnesota on the screenings from mills and elevators. This feed is proving excellent for the purpose. Because of bits of straw and chaff in the screenings, fattening sheep do not surfeit so easily on screenings as on maize grain, and they may even be fed without giving any hay in addition."

A large proportion of the slaughter sheep of the United States are fattened on maize grain. The Michigan, Wisconsin, and Minnesota Stations have studied the ration of maize grain and hay required for fattening lambs; they found that lambs averaging 81 lb. each, during feeding trials averaging thirteen weeks in length, made gains of three-tenths of a pound per head daily, requiring about 500 lb. of maize grain and 400 lb. of hay for 100 lb. increase in live weight (*Henry*). The average daily ration of the 45 lambs tested was 1.42 lb. of maize and 1.03 lb. of hay per lamb. The highest average daily gain was obtained with the highest average daily ration of maize (1.53 lb.); this ration was also the most economical, for it required both the smallest weight of both maize and hay to produce 100 lb. live weight.

Henry concludes that maize is the best single grain for lambs, causing them to put on fat rapidly and not forcing growth as is the case with some other concentrates. Except in rare cases (such as valuable breeding sheep with poor teeth), whole grain only should be used for sheep, for of all farm animals the sheep is best able to do its own grinding. There is a common saying of stock feeders that a sheep which cannot grind its own grain is not worth feeding.

MAIZE FOR PIGS.

If barley is the natural food of the domesticated English pig, maize is certainly the natural food of the American hog, and will also be that of the South African. In America, Henry says that, although the special function of maize in pig feeding is the production of fat, maize, as being the cheapest grain, must continue to be the common feeding stuff for pigs.

"Having a proper knowledge of its composition and limitations, the feeder is in a position to wisely use this great cereal. For breeding-stock, maize should constitute not over half the ration at any time, the amount being smallest with young animals. As the body increases in size and nears maturity, the demand for protein and ash becomes less, and the proportion of maize to other grain can be gradually increased until, during the fattening stage, the ration may, if desired, consist almost wholly of this grain."

There can be no doubt that many valuable sows have been utterly ruined for breeding purposes by over-feeding on maize and meal which, alone, possess too much heat-producing and too little bone and muscle forming material to supply the needs of the animal economy. On this account sows should not be allowed to run with fattening hogs kept on maize but in pasture, and allowed plenty of sop made of equal parts of shorts, maize meal, and wheat bran. (F. D. Coburn, "Swine Husbandry.")

Henry summarizes the investigations of the several American

experiment stations with regard to pig feeding, and finds that pigs weighing less than 50 lb. each, averaging 38 lb., consume on the average 2.23 lb. of grain or grain equivalent daily. As the animal increases in weight there is a gradual increase in the amount of food consumed, until the 450-lb. pig was eating 10 lb. of grain daily, or more than four times as much as the 50-lb. pig.

He finds that when pigs have maize as their exclusive ration, they acquire a strong craving for wood ashes, considerable quantities of which are consumed if opportunity offers. He experimented to determine whether the ashes were of any benefit to the pigs or not. "As the trials progressed, it became evident that none of the pigs were properly nurtured, though the difference in favour of those getting bonemeal or ashes was very marked. The pigs which were allowed neither ashes nor bonemeal were most plainly dwarfed. It was evident that the maize meal, salt, and water did not supply all the elements essential to building a normal framework of bone and muscle. These dwarfs became so fat that the jowls and bellies of some of them nearly touched the ground. [For further information on the effect of an excess of maize in the ration on the character of the bones, see Ohio Sta. Bull. 201, p. 164.]

"The pigs getting ashes or bonemeal grew very well for some time, but toward the close of the trial they made only fair gains, showing that the nutrients supplied were still too limited in character to allow normal development. . . . Feeding bonemeal or hard-wood ashes to pigs otherwise confined to a maize-meal diet effected a saving of 23 per cent. in the maize required for 100 lb. of gain; . . . the strength of the thigh bones was about double that of pigs not allowed bonemeal or ashes. . . . The bones . . . of the pigs getting ashes or bonemeal contained about 50 per cent. more ash than the others; . . . and still retained their form after burning, and did not crumble when carefully handled," while the others crumbled at once on handling. Henry attributes the strengthening effect of the ashes to the lime present.

He also notes a growing demand for leaner pork. As maize is a fat-forming food, he advises that the demand can be met by "using more protein-rich feeds, with less maize, during the growth of the pig, and especially by shortening the fattening period. Feeding the by-products of milling, oats, barley, or the waste products of the dairy with maize, the fattening period not being unduly prolonged, produces pork which will easily meet the requirements of the most discriminating market."

"Whether maize should be fed whole or as meal depends upon circumstances. If the kernels are so hard as to cause sore mouths, thereby preventing easy mastication, the grain should be ground. If no trouble arises from this source, the utility of grinding hinges on the relative cost of grain and grinding. . . . Some grain is saved (in feeding) by reduction to meal, and the feeder can easily estimate whether he should incur the extra expense of grinding. Where grinding is not possible, hard maize may be prepared for feeding by soaking the grains. Ear maize and shelled maize can be satisfactorily fed to fattening pigs upon a feeding floor of matched lumber swept clean each day. Maize meal should always be soaked with water before feeding, the dry meal being unpalatable. Remembering that feeds in combination are better than the same

feeds given singly, the prudent stockman will provide some complementary feed for pigs getting corn, even though the proportion of the secondary feed be small."

MAIZE FOR POULTRY.

In England there is an extensive trade in maize for feeding pheasants and poultry. For this purpose the small grained sorts, such as Odessa, Galatz, Bessarabia, and Cinquantina, are preferred. This class of maize commands from 5d. to 7½d. (rarely up to 1s. 8d.) per muid more, in the London market, than the larger-grained classes. Unfortunately these types are, in South Africa, poor yielders, and the extra price obtainable is not sufficient to compensate for the smaller crop.

In warm climates, maize seems to be too fat-forming a food for poultry, except in the winter months, and Mr. Bourlay, the Poultry Expert of the Department of Agriculture, recommends that even then it should not be used more than three times a week.

A Transvaal farmer once remarked to the writer: I don't sell my mealies, but give them to my wife. I tell her that a bag of mealies will feed ten fowls; she can at any time sell those ten fowls for the table at 1s. 6d. apiece, which is 15s. in all. How else can I get 15s. for a bag of mealies? He might have added that he also got the "droppings" from his ten fowls, which make excellent fertilizer for the garden.

MANURIAL VALUE OF FOODSTUFFS.

A factor of importance in determining the relative values of foods is their effect in enriching the excreta of the animals which consume them, and thus adding to their manurial value. This aspect of the question is fully recognized in most European countries and in the United States. Ingle gives the following example (L. 6): average samples of linseed cake contain 4.75 per cent. of combined nitrogen, 2 per cent. of phosphoric acid, and 1.4 per cent. of potash. Although a certain proportion of these constituents is retained in the animal, being used in forming new tissue, the larger proportion eventually passes into the excreta and is available for manurial purposes. The proportion of the whole retained in the body varies greatly with the age and condition of the animal, being greatest in young animals and least in adult working animals. In English farm tenancy, compensation is paid by the incoming to the outgoing tenant for every ton of food consumed, on the basis of the assumption that half the nitrogen, three-quarters of the phosphoric acid, and all the potash passes into the excrement; and that (1) all the constituents from the food consumed on the farm the previous year, (2) half those consumed two years ago, (3) one-quarter of those consumed three years ago, and (4) one-eighth of those consumed four years ago are still available in the soil.

Messrs. Voelcker and Hall (V. 7) have prepared a table showing the valuation per ton as manure of the leading foodstuffs; this was reprinted by Mr. Ingle in the *Transvaal Agricultural Journal* for 1906 (I. 6). They show that the oil-cakes, pulse, and leguminose hays, as naturally to be expected, have the highest manurial value. The cereals take the following sequence in compensation value for each ton of food consumed during the previous year; the money values

would not be the same in South Africa, but their relative value would be approximately the same:—

	s.	d.
Malt culms	35	11
Wheat bran...	28	11
Oats	15	5
Malt	15	2
Wheat	14	10
Rice meal	14	3
Barley	13	9
Maize grain...	13	0
Oat straw	7	7
Barley straw	6	9
Wheat straw	6	5

Henry (H. 20) gives the fertilizing constituents in 1000 lb. of certain maize products as follows:—

	Nitrogen. lb.	Phosphoric Acid. lb.	Potash. lb.
Maize grain (average of all American analyses)	18.2	7.0	4.0
Dent maize grain...	16.5	—	—
Flint maize grain	16.8	—	—
Sweet maize grain	18.6	—	—
Maize cob	5.0	0.6	6.0
Maize and cob meal...	14.1	5.7	4.7
Maize bran	16.3	12.1	6.8
Gluten meal	50.3	3.3	0.5
Germ meal	26.5	8.0	5.0
Starch refuse...	22.4	7.0	5.2
Grano-gluten...	49.8	5.1	1.5
Hominy chops	16.3	9.8	4.9
Glucose meal	57.7	—	—
Sugar meal	36.3	4.1	0.3
Gluten feed	38.4	4.1	0.3

Sugar-cane in South Africa.

By Herbert J. Choles, F.S.S., Department of Agriculture.

(Continued from Page 583.)

HARVESTING.

In from twenty to twenty-four months the canes are ready for harvesting. This is true not only of the first cutting (the plant canes) but also of the subsequent ratoon crops. For instance, if five cuttings are obtained from the one planting—one cutting of plant canes and four of ratoons—the crop may occupy the land for ten years without replanting. But whilst a number of ratoon cuttings may be taken, it should be observed that with each subsequent cutting of ratoons a smaller crop is obtained.

Cutting the canes.—The canes are cut with hatchets or cane knives, as close to the base as possible, as the best juice is contained in the lower portions, whilst new vigour is also given to the young plants, or ratoons, that spring up from the old roots. The tops are then trimmed off, including one or two joints. The removal of one joint is generally sufficient with canes grown on very dry soil; otherwise it is advisable to cut off two. The deciding factor is the degree of maturity of the uppermost portion; if the top joints are not sufficiently matured, their juice, instead of affording an increased quantity of the sugar, will only injure it.

The canes are then stripped of their leaves.

As the canes are stripped they should be watched for signs of damage by rats, and any showing the attacks of these rodents should be discarded and not sent to the mill, since they might tend to sour the juice.

Tramways.—The canes are then placed on the wagons or trucks and conveyed to the mill or railway station for consignment to the central mill. On most of the larger estates in Natal light portable tramways are laid along the most convenient routes, and these are fed by roadways from the field not immediately served by the line. As found necessary from year to year these lines can be taken up without difficulty and laid elsewhere, as they are made in permanent sections, which only need to be fitted end on end along a fairly level road. As a rule horses or mules are used for draught power. On the largest estates properly laid railways, with locomotives as the tractive power, are to be seen. In Mauritius, Queensland, the West Indies, and Guatemala, overhead wire tramways have been installed and are proving a success. These are not cable-hauled trucks running on rails, such as are used on the Rand mines for dumping work, but are overhead cables from which the trucks are suspended by means of trolleys, cables being used for hauling, and the hauling drums being situated at the mill. Newlands gives the following description of the system: "The cane is carried in a hook, which is hung from the rope by the rope at a speed of three miles an hour. The cane is put on to the tramway by means of a travelling shunt-stage, which

is moved from end to end of the tramway, and on the shunt-rails of which the carriers run from the rope, are loaded, and placed on the return wire rope to go to the mill with their load. Thus only the portion of the tramway rope between the mill and movable shunt-stage is employed in carrying the loads. When necessary, the terminal of the tramway can be mounted on wheels, and the driving gear arranged to allow the tramway to radiate to any portion of a circle, so as practically to reach any point of a field." The tramway can ascend inclines as great as one in three; it is therefore of particular advantage in hill work. By its use cane can be transported across streams or bad ground, such as swamps, without any trouble. An advantage of the system, too, is that by its means the mill can be fed with a continual stream of freshly cut cane, thus obviating the accumulating of cane outside the mill, as the feed can be regulated nicely to the capacity of the crushing machinery. The cost of these tramways is approximately £200 per mile, and they can be made to deliver anything from fifty to five hundred tons of cane per ten hours.

Cane Loaders.—During the past years cane loaders have enjoyed an increasing vogue on large estates throughout the world. The general principle is that of a grapple suspended from a small travelling crane. This enables the wagon or truck to be loaded with despatch, and saves considerable labour.

Windrowing.—In countries where the danger of frost at harvest-time necessitates the taking of special precautions, the practice of windrowing has been adopted. From two to four rows of cane are thrown into one furrow in such a way that the tops of the last thrown down will always cover the butts of the preceding lot. The canes will then keep, unharmed by the frost until they are taken to the mill. Another plan is to stand the canes with their butts on a dry piece of land and then heap up earth around the stack. About half an acre's cuttings usually go to form one stack.

Yield.—Thirty tons of cane to the acre is considered in Natal a good crop, although on newly cleared bush land as much as sixty tons and more has been obtained. The average in the Natal plantations probably does not exceed thirty tons.

Maturing Period.—From the middle of June to the end of November is about the average time of maturity. Cutting, however, generally commences in April and continues until December or January. In fact, the shortness of labour and the limited capacity of many of the mills often cause the harvesting period to extend over nine months, and sometimes even right through the year.

Keeping Qualities of Cane.—On some estates in Natal it is the practice to allow canes to dry before crushing. The question of the effect of keeping cut canes for a time upon the percentage of available sugar has been investigated in India. A number of cartloads of cane were cut at the same time, and one cartload was then crushed on each subsequent day. The results appear in the following table:—

Days cut	0	1	2	3	4
Available sugar (original sample=100) ...	100	97·3	92·0	78·6	67·9
Total loss available sugar	0·0	2·7	8·0	21·4	32·1
Daily loss available sugar	0·0	2·7	5·3	13·4	10·7

It will be seen from this table that the quantity of sugar available becomes less as the period between cutting of the cane and crushing increases; also that, whilst the daily loss of available sugar is comparatively small, this increases after seventy-two hours.

Replanting.—It may be laid down as a safe rule that, according to circumstances, when the yield falls below twenty tons of cane to the acre replanting is necessary.

RATOONING.

After the canes have been cut new shoots are sent up from the old roots. These "ratoons," as they are called, mature and are harvested just as the original "plant canes." Cultivation, too, to keep down weeds, form a dust-mulch to check evaporation of soil moisture and admit air into the soil, is carried on as before.

Perpetual Ratooning.—Ratoons will spring up year after year if allowed to; this is, in fact, practised in Jamaica, where perpetual ratooning is carried on. This system has both its advantages and its disadvantages. Its principle disadvantages are that with each succeeding season ratoon canes steadily diminish in length of joint and in circumference, and consequently in their sugar-producing capacity. The reason of this is that the roots of the buds are fewer than in the case of the original plant canes, and are closer to the surface of the soil. The natural consequence is that they supply less nourishment to the growing canes. Moreover, the soil cannot be stirred as effectually as in the case of plant canes, owing to the proximity of the roots to the surface.

It is claimed for the system of perpetual ratooning, on the other hand, that, although the yield of sugar from ratoons is less than from plant canes, in some cases the grower secures quite as much profit when the relative working expenses of the two systems are taken into consideration. In Jamaica, at any rate, the principle is apparently found quite a sound one, even though the average production of sugar per acre is small (about 12 cwt.). Moreover, the risk of losing young plants through drought is avoided. Crop rotation cannot, of course, be practised. As regards manuring this would appear to be difficult of proper accomplishment owing to the nearness of the roots to the surface of the soil.

The general practice, however, is to plant canes, ratoon for two or three years, and then replant, and the beginner would certainly be wise to adopt this method, at any rate until such time as he has had sufficient experience of local conditions—upon which only can the question be decided—to enable him to form a wise judgment in the matter.

Where white ants are prevalent, it may be added, ratooning for more than one or two seasons is certainly not to be advised, as the frequent breaking up of the soil for replanting tends to break up their nests and destroy them.

Cultivation.—As has been said, cultivation proceeds with the ratoon canes as with the plant canes. In this connection an interesting discussion of the question of the cultivation of ratoon canes appears in a report issued by the Imperial Department of Agriculture for the West Indies on manurial experiments with sugar-cane in the Leeward Islands for 1907-08. A summary of the observations contained in this

report appeared in the official organ of the department, *Agricultural News*, in its issue of the 17th April, 1909, to which journal I am indebted for the notes that follow.

In the Leeward Islands it would seem that tillage operations in connection with the growth of ratoon canes are much more generally carried on than at Barbados, where on the majority of estates in the ratooning districts the land is simply trashed after removal of the plant cane crop, but little or no cultivation is done. At Antigua and St. Kitt's, on the other hand, it is a common practice to break up the soil between the young ratoon stools to a considerable depth, when the cane shoots are in a state of vigorous growth and have reached a height of two or three feet with the object of bringing the land into good tilth. Either the plough or the fork is used for these operations. The cultivation thus given is more than a mere surface tillage to provide a dust mulch; it involves *deep* tillage, and the soil is turned over and broken up.

Planters who cultivate their ratoons in the manner mentioned state as a reason for these operations that they are necessary on account of the degree in which the soil has consolidated and hardened, but if the land were thoroughly tilled and prepared previous to setting out the plant cane crop it should seldom require the treatment referred to on the removal of the first crop. On heavy classes of land where two or three crops of ratoons are grown some amount of tillage may be advantageous for the purpose of lightening and aerating the soil, but this operation would best be carried out as soon as possible after the previous crop has been reaped. If deferred until an extensive growth of shoots and roots has taken place the injury to the young roots may entail considerable damage, and, further, the loss of moisture which is involved by inverting the soil is more harmful than at an earlier stage of growth, although, of course, always to be avoided if possible. Loss of moisture during the period of vigorous growth is a very serious matter, and may entail a check on the young ratoons from which they will not easily recover.

Before the work of tillage between the rows of ratoons is proceeded with planters would do well carefully to examine their fields by actually digging across the banks which they propose to fork or plough in order to satisfy themselves that the soil is in as great a need of tillage as they imagine, and to assure themselves also that the operations which they perform improve the soil as much as they think. On turning over the beds of trash underlying a young crop of ratoon canes of satisfactory appearance the soil below will usually be found in a condition suitable to promote good growth.

The following notes on this matter are quoted from the report referred to above. It is mentioned in the report that the notes are submitted for consideration and discussion rather than as direct recommendations:—

"It would thus appear that the soil when well covered by the trash from recently cut plant canes is frequently in fair tilth and not unduly compact. If kept covered it retains both its tilth and moisture. If the trash is removed and the soil is turned up to a considerable depth, and afterwards exposed to the sun, it loses moisture and sets back into a harder condition than before. If, however, the tilth is imperfect and cultivation is regarded as essential the soil should be stirred as soon as possible after the plant canes are cut and before the

ratoons begin to grow to any appreciable extent. Following this the rough soil should be harrowed at once to break any lumps, and should then be covered with trash or should be constantly stirred to a depth of about two inches in order to create and maintain a dust mulch, which will go far to supply the effect of trashing in conserving the moisture in the soil.

"Much of the cultivation now given to ratoon canes is possibly injurious."

Under the heading "Manures" we have already noticed the recommendations of the Cuban Experiment Station in regard to the fertilizing of ratoon canes. We have seen that the trash after cutting is drawn into every second space, the bared spaces being manured. The alternate spaces are thus so heavily trashed that practically no grass or weeds can come through, and these portions need no further attention during the season. The following year these trashed spaces are bared after cutting, the trash being now drawn into the alternate spaces which were manured the previous season; fertilizers are applied, and thus the operation is reversed every year. The effect of this system is that the soil all over the field is thoroughly aerated and pulverized once in every two years.

THE FINANCIAL SIDE.

Mr. Leonard Acutt, J.P., of Tongaat, Natal, a prominent sugar planter, gives* the following statement as representing the estimated yield and cost per acre:—

First Crop.

25 tons of cane at 10s.		£12 10 0
Preparing land	£2 10 0	
Planting	1 0 0	
Five weedings at 6s.	1 10 0	
Supply and sundries	0 10 0	
Two years' rent	1 0 0	
Cutting and carting to factory ...	4 0 0	
		10 10 0
Profit of first crop ...		£2 0 0

Second Crop.

25 tons of cane at 10s.		£12 10 0
Weeding and cultivation... ...	1 10 0	
Two years' rent	1 0 0	
Cutting and carting	4 0 0	
		6 10 0
Profit second crop ...		£6 0 0

"This is, of course," he observes, "without any charge for supervision, manure, or interest on money. The price of cane should average more than 10s. a ton over the next few years.

"Besides this the small farmer could get crops of mealies or beans off between the cane, and would also have plenty of fodder for his animals after the first year.

*"Notes on Agriculture in Natal" (Natal Department of Agriculture, 1905).

"If the fields are looked after and manured well—as probably the small farmer would be able to do—the crop can be cut several times (perhaps ten times) without replacing at intervals of twelve to twenty months, and, in effect, give after the first crop a profit of about £5 per acre per annum.

"The existing factories would probably be willing to give 10s. per ton for cane delivered, but, of course, if our output is to be largely increased more factories will have to be erected."

FACTORY OPERATIONS.

The treatment of the cane and the juice at the mill differs in no important respect in the Natal factories from that in other countries. The cane is crushed, as the diffusion process has not come into vogue in Natal.

The following may be taken as an indication of the general course of operations at one of the larger factories. At the smaller factories, of course, the operations are less complete:—

Where cane is bought from outside supplies it is paid for at a uniform price (generally 10s.) per ton, provided the juice does not fall below an arbitrarily fixed Beaumé standard, in which case the supplier is credited with a correspondingly smaller tonnage. The cane, which is brought to the factory on trucks, is fed to an endless carrier, whose intake is outside the mill, and which discharges it into the rollers. The mill proper—that is, the crushing apparatus—is double, consisting of a first set of three rollers, an intermediate carrier for maceration, and a second set of three rollers for a second crushing. It is estimated that, with such a plant, 65 per cent. of juice is extracted from Uba cane, and from 70 to 75 per cent. from softer canes. With a modern 14-roller plant, with maceration, however, 74 per cent. or more of the juice can be extracted from Uba cane.

After straining, the juice proceeds from the mill tank to the sulphuring tank. Here an injection of sulphurous anhydride takes place, after which the treated juice passes to the tempering tanks, when it is limed until neutral. Then it circulates through three vertical heaters, passing afterwards to subsiding tanks. Here the clear juice is syphoned off and gravitated to the quadruple effect, the bottom being pumped into filter presses from which the juice runs to the quadruples, the cake being thrown on the compost heap. The concentrated liquor in the quadruples now goes to subsiders. From these the clear liquid passes to the vacuum-pan feed-tanks, from which it is sucked into the vacuum pans. These consist of smaller tanks of copper and larger ones of iron. From the large iron pan the massecuite is dropped into a mixing tank from which it passes to the centrifugals. These are driven by machinery, and it is from them that the sugar is obtained, the first sugars being marketed for direct consumption. Formerly, from the molasses four other grades of sugar were obtained, and these were sent to the refinery for further working up; but with the modern process (double centrifugalling) 98 per cent. recovered sugar is marketable, only 2 per cent. being of low grade.

A notable feature in some of the up-to-date factories is the increasing tendency to substitute electric for steam power for the driving of the centrifugals and the subsidiary machinery of the mill; the consequence is greater cleanliness, less heat, and great saving in labour for attention, and in fuel consumption.

Bagasse, or the fibre of the cane after the juice has been extracted, is as a rule used as the fuel for the furnaces. The former practice was to dry the green bagasse in the sun before feeding it into the furnaces. This difficulty was overcome some years ago by Mr. Gilbert Wilkinson, son of one of the early Natal planters, who invented a special furnace which obviates the necessity for drying the bagasse. The green bagasse is fed into the furnace—after the latter has been started with coal—in conjunction with air previously heated in a chamber to a temperature of 200 to 250 degrees by the gases escaping to the chimney. A little coal is fed at intervals to maintain the heat of the furnace to an orange colour, or 2000 to 2200 degrees during the day. The water is decomposed, and the constituent gases (oxygen and hydrogen) burn fiercely. The introduction of better crushing machinery has, however, reduced the percentage of moisture in the bagasse very considerably, and in the modern furnaces this moisture is evaporated ere the bagasse come to be burned.

There are various objections to the old system of drying the bagasse in the sun first. One is the labour required as the outer surfaces of the bagasse are skinned as it dries. Further, it is fed into furnaces having too low a temperature to decompose the water. Again, the fermentation which occurs during the drying process results in the loss of the residue of sugar which the bagasse contains, and sugar is a very inflammable constituent. The difference in the labour required for the two systems amounts to this, that in the former method there is light work for one Indian, whilst in the latter method there would be exhausting work for three Indians.

It takes anything from 12 to 30 tons of Uba cane to produce 1 ton of crystals (Pearson). A first-class factory has been known to obtain 1 ton of crystals from 12½ tons of Uba cane as a season's average; that is to say, every 100 tons of cane produced 8 tons of crystals. These 8 tons of crystals would contain probably 7⅗ tons of pure sugar.

Dr. Watts has prepared a simple formula for the approximate calculation of the quantity of juice in a cane. From 100 deduct, he directs, one and one-third times the percentage of fibre in the cane. Calculating thus we get the following convenient table:—

10	per cent.	fibre =	86.7	per cent.	of juice.
11	,,	,,	85.3	,,	,,
12	,,	,,	84.0	,,	,,
13	,,	,,	82.7	,,	,,
14	,,	,,	81.3	,,	,,
15	,,	,,	80.0	,,	,,
16	,,	,,	78.0	,,	,,
17	,,	,,	77.3	,,	,,

Dr. Watts goes on to observe: "A number of experiments have demonstrated that the ordinary three-roller will leave in the megass from 150 to 180 parts of juice per 100 of fibre, or even more if very poor work is being done. The megass from a single mill with a cane splitter contains about 120 to 130. That coming from a train of mills consisting of a Krajewski cane crusher and two three-roller mills, in which maceration is effected, contains from sixty-five to seventy; while the megass coming from a train of mills consisting of a Krajewski cane crusher and three three-roller mills employing maceration may be reduced to a content of twenty-five to thirty. In order to show the influence of the fibre in the canes, and the influence of the mill on the

number of tons of cane required to make a ton of sugar, the following table has been prepared, showing the tons of cane required to make 1 ton of sugar from canes of different fibre contents under different milling conditions, assuming juice to contain 1.95 lb. of sucrose per gallon:—

Kind of Mill.	*Fibre in Cane.*		
Muscovado.—	14 per cent.	15 per cent.	16 per cent.
Bad single mill	13.7	14.6	15.6
Fair single mill	13.0	13.7	14.5
Good single mill	12.1	12.6	13.3
Factory (Crystals).—			
Double crushing and Krajewski	8.8	9.1	9.3

"All these figures justify the general conclusion that, under conditions where 13½ tons of canes are required to make a ton of muscovado sugar, a ton of crystals can be made in a modern factory from 9 tons of canes. If the canes dealt with are of such a quality that more or less is required in one case, a corresponding amount more or less will be required in the other."

DISEASES OF THE SUGAR-CANE.

The sugar-cane plantations of Natal are strikingly free from original troubles of any sort. Destructive insects and disease are conspicuous by their absence, and in view of the consistent efforts which have been put forward to prevent the introduction of pests from abroad, there is every hope that this happy state of affairs will long continue. During the period of locust invasion the cane fields suffered constant damage, but this form of insect attack is now a matter of past history.

Among the minor troubles, Mr. Fuller, Government Entomologist, records the mealy bug, the cane caterpillar, and the fungus disease known as cane spume.

There has been an isolated outbreak of white grub which appears to have been quite sporadic; and in times gone past, when China cane was grown, smut seriously attacked this variety. The disease spoken of as cane spume and the cane mealy bug are seemingly quite innocuous to the Uba variety, now almost exclusively grown in Natal.

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Notes on Ostrich Chick Rearing.

By Arthur G. Long, Prieska.

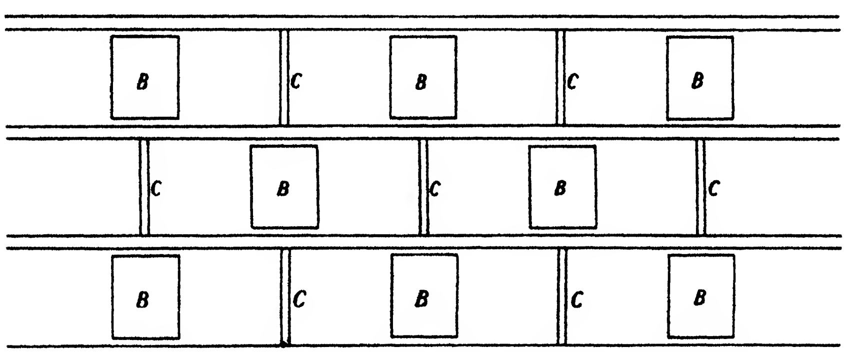
The majority of ostrich farmers have, I am glad to say, within the past few years realized that the old careless and haphazard methods in rearing or attempting to rear their chicks did not pay. But there are still many who lag behind and are by no means so progressive and careful with the tending and dosing of their chicks as they might be. There still are farmers who allow their chicks to be herded by small irresponsible boys or native women, put the birds anyhow into small boxes at night in cold outhouses with a sack only to keep them warm, and when dosing use a dirty spoon or a bottle with a piece of stamp paper stuck on as a measuring mark.

Farmers must pay more personal attention to their birds. These farmers I refer to will bestow infinite more care and attention on their kids and lambs than on their chicks. I know a farmer, well known in South Africa as an ostrich man. His name regularly figures in the prize lists at the premier shows, and he has his chicks herded by a little kaffir boy. Yet that same man employs a full-grown native to herd his few bastard sheep at full pay and rations, and woe betide the boy if he is found asleep or away from his flock! During a recent season this farmer reared under fifty chicks from over twelve pairs of breeders. Can it be wondered at?

An adult herd should be employed. An elderly native is far better than a young irresponsible boy. The majority of natives that are in any degree trustworthy usually fight shy of chick herding. From their point of view—in managing natives half the battle is won if one looks upon things from their point of view as well as one's own—sitting by ostrich chicks is a little boy's work and they fear ridicule from other boys. So the farmer must make it worth the boy's while to take on such a job. Give him full pay and full rations, and give him a commission of 6d. or 1s., or even more, for every chick that is reared to four or six months old. Let him understand that 200 chicks will bring him in £10, and he will forget all about being ridiculed by his brethren.

As soon as the chicks arrive, if the weather be cold, let them remain in the incubator or under the hen for the first twenty-four hours, then as soon as the sun is warm enough put them out. Any draught or cold at this early stage of their lives is fatal. See, therefore, that they are in the sun out of the wind. If the sun is too hot, make an awning for them out of some sacks ripped up and sewn together and laid on three or four staves let into the ground. Whether food should be given them during the first two or three days of their existence is a matter of opinion. Personally I am in favour of feeding them, but great care should be taken to see they get food they can digest. If lucerne be chopped up, only the leaves should be given, cut very finely. On no account let the tough stalks be cut up too. Messrs. Spratts turn out a very useful food for young chicks named "Egfo," a few handfuls thrown amongst the birds is sufficient,

Finely ground bone and shell should also be scattered amongst them. The third day have them carried to the lucerne land and let their herd take charge. Like everthing else, there is a right and wrong way even in carrying chicks about. I use a light strong box with rope handles, large enough to hold thirty or forty birds which two men can carry. The less a young chick is handled or shaken the better, so the box should be carried slowly and carefully. See that plenty of finely crushed bone is given them and provide shade from the midday sun. When possible, put chicks on a land that has not been grazed by ostriches the previous season, their sleeping quarters being built near by. Do not let the birds graze on lucerne for more than four hours at the most each day. Too much lucerne and rich food with no exercise leads to congested liver. Let them be taken to the veld and have plenty of exercise. One of the greatest secrets of success in chick raising is keeping them warm at night and at the same time giving sufficient ventilation. The shed in which they sleep should, of course, be devoted to chicks and nothing else. I have seen chicks put in boxes on a cold cement floor, and an iron roof unceiled above, in harness-rooms, stone-rooms, even cow-houses and stables.



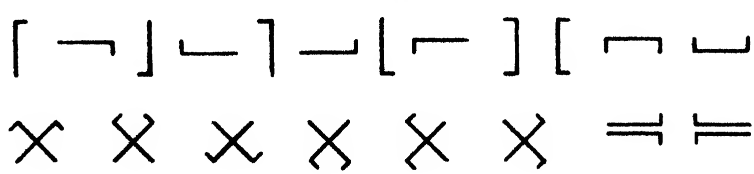
AA are long deals, BB paraffin tins, CC wooden partitions.

A chick-house should be portable, with an earth floor, and the roof of iron must be lined to keep out that cold which comes an hour or two before dawn. The best I ever used was an unlined flat-roofed wood and iron hut, 12 feet by 14 feet. I lined it inside with sailing, roof included, and stuffed it with lucerne hay, having ventilation spans which could be closed at will. This made an excellent warm room and cool during the day. Quite the best plan for keeping chicks warm at night is to have paraffin tins filled with hot water the last thing at sundown. Cork them, tie a sack round each one and arrange them as illustrated, allowing, say, six chicks or less according to size to nestle against each tin. I have kept chicks warm on the coldest nights by this method, the water remaining hot for over twelve hours.

Every morning as soon as the birds are turned out the herd should remove all the deals, tins, etc., and thoroughly brush the floor, wheeling in a barrow all the droppings to some place to which the chicks can have no access. Clean sand should be thrown on the floor and all ventilators opened. Periodically, Jeyes' fluid or carbolic dip should be sprinkled about.

Branding for Identification.—The greatest care must be taken when branding chicks, using brands that are clear and distinct and not likely to confuse one at a later period. Chicks can be branded as soon as they are taken from the nest or incubator. An excellent brand can be made out of a small strip of tin or zinc, or, better still, copper. It should not be longer than one inch. I use an L-shaped brand which will produce the multitude of different brands required for each different clutch or batch. The accompanying sketch shows a few examples of how this brand can be applied. The best spot for these identification brands is on the side of the body just behind the thigh. There are no feathers then, and if the brand is properly applied will remain clean and distinct for years.

In branding chicks one should have everything ready at hand—the irons. a small spirit stove (a Primus is the most useful kind), an assistant to hold the birds, and a book in which to make a note or record of the brands of the different clutches. Heat the brand in the flame (a few seconds with a Primus will suffice), have the chicks held ready by your assistant, and just touch the skin. Then enter the brand in the book for future reference with all particulars of that particular clutch, when hatched, names of parents, etc. A good brand should appear as a dark firm scar or scab. If the iron is too hot or pressed on too deeply it will penetrate the epidermis or outside skin,



and the result will be a sore which will take some time to heal, and also the brand will be spoilt. It is better far to brand too lightly than too deep. In a fortnight's time look through the chicks and rebrand any that may need it.

The next step in the identification of the birds is taken when the first plucking (spads) is ready to clip. Far too little attention is paid to the identification of ostriches. The most sure method is by inserting a numbered button into a certain part of the wing. These buttons and the necessary implements for fastening them can be obtained from various firms, and the system is so well known that it needs no explanation here.

When the spads are ready to be clipped the bird is usually big enough to be buttoned, and the number of each bird should be entered in the identification book along with the original chick brand. I use a special book with a page for each bird, entering when plucked, quilled, etc.; and so have an accurate record of each bird, which, of course, is most essential when selling or pulsing birds out for breeding.

With regard to the dosing of chicks for the various diseases they are subject to, so many excellent articles have been written by Dr. Robertson, Professor Duerden, and others, that there remains but little to be said. However, I would point out how extremely essential it is, when using doses recommended by them, to follow their instructions most carefully; use proper measuring glasses and weigh all solids with proper scales. Spoons, cups, etc., vary so in size that it is most risky to use them for measuring purposes.

Natal Agricultural Union.

ANNUAL CONFERENCE AT MARITZBURG.

The annual conference of the Natal Agricultural Union was held in the Town Hall, Maritzburg, on the 22nd, 23rd, and 24th April, under the chairmanship of the President, Mr. C. H. Mitchell. The attendance of delegates from affiliated associations was well up to the standard of previous years, and the following officials of the Department of Agriculture were also present, viz.: Mr. C. Gray (Principal Veterinary Surgeon), Mr. Alex. Holm (Under-Secretary for Agriculture), Mr. Claude Fuller (Assistant Chief of the Division of Entomology), Mr. Wm. Power (Senior Veterinary Surgeon, Natal), Mr. E. Harrison (Principal of the Cedara School of Agriculture), and the Acting Editor of the *Agricultural Journal*.

The proceedings were formally opened by the Hon. Joseph Baynes, who, in the course of his address, referred to the many disabilities and the phenomenal drought, followed by torrential rains, which the Province had to bear. There was a belief, Mr. Baynes observed, that troubles were sent to try us. Try us they certainly did, but oft-times the gravest troubles were the greatest blessings. The drought had taught them the imperative necessity of water conservation and the laying by of food stocks; the recent floods, the proper drainage of their lands and the taking of preventive measures against soil erosion, while the biggest blow of all, East Coast fever, was to-day acknowledged to have been the richest fount of good among all the cattle evils of our time. Speaking on the subject of dairying, Mr. Baynes said: "I realize the enormous importance of this particular industry to South Africa. I urge you with all my heart, and not with any lively sense of personal gain (for my days of activity are drawing to a close), to learn well the lessons of other dairying countries. Raise good milking strains, plant grasses and winter feed, so that there will be no interruption in your milk supplies. See to it, in short, that your methods of dairying follow in every respect those of other lands similarly placed, which have established themselves in the markets of the world, and from whose costly experience you may freely benefit if you will. South Africa has it within her power to rank amongst the great dairy producing countries of the world. So says Mr. Challis, and it is true. Her coast lands are magnificent, but neglected; her population sparse; her vast spaces desolate of man or beast. And yet the markets of the world are at our feet when once our own are satisfied—which should not be very long. What a grand opportunity here for closer settlement and a handsome return. Bring your energies and influence to bear, gentlemen, on the rectifying of that deplorable crime—the crime of waste—and you will have done well in your generation. And one word more. Do not forget the possibilities that lie before us in beef and bacon and ham production. The export of South African meat is a nearer thing than many think."

PRESIDENT'S ADDRESS.

The report of the Executive Committee having been read, the President, in moving its adoption, said:—

"Gentlemen,—It falls to my lot once more to move the acceptance of the committee's report, and, in doing so, I would like to make the usual few remarks on the agricultural outlook. Last year will long be remembered in South Africa as a year of drought; from that drought Natal suffered with the other Provinces, though, on the whole, I think a good deal less than the rest; still, it suffered badly enough and the effects have by no means passed away yet. The drying out of the water in the sub-soil was particularly hard on timber and fruit trees; many died right away, others were badly stunted, and this season's fruit crop has been reduced very considerably.

"The result of the drought that caught the public eye most was the great rise in the price of maize. This rise I consider was most unfortunate to the country as a whole, farmers included, and though I know it is usual to blame the Government for all our ills, from thunderstorms to blowflies, yet I do think that if a proper statistical bureau had been instituted by the Union Government, or even our old ones kept in working order, we should never have had the over-exportation of maize last year and all that it entailed.

"Very few farmers benefited by the high prices reached at the end of the year; the average maize grower sells his crop as soon as it is fit to shell—he needs the money and has not the conveniences for storing. The speculators got the advantages of the rise. On the other hand, the stock breeders and dairymen were badly hit. Many of our best stock districts will not grow maize, so that the stock owners are obliged to buy their grain rations. To such, mealies at £1 a bag or over means a very heavy loss, and such prices check the development of the industries.

"The bacon industry in the same way had a severe blow, for no farmer dare lay himself out for a big output of pigs with a risk of such prices for food. What the maize grower needs is a regular market for his produce at a fair price—he gains little by these violent fluctuations. It is greatly to be desired that provision be made for the regular collection and publication of full reports on the prospects of crops, etc., the same as is done in all other civilized countries.

"The problem of our labour supply is still with us—it usually has the place of honour at all agricultural meetings and many an anxious hour must each of us have given to the consideration of our own particular phase of it. At the present time it is not so acute in Natal as it often has been; the prolonged drought turned out nearly all the available labourers from their kraals and the absence of any large public works has made more labour available for the farmer. This phase will pass, however, all too soon, and with normal crops and the starting of new railway developments we shall soon once more see the old times of strain and stress.

"For good or ill it has now become the settled policy of the country that no further importation of coloured labour will be allowed, and that any shortage in supply must be made up with white labour. In this direction the Government has already given a lead, some thousands of white men being employed on railway works in the adjoining Provinces.

"Every one of us wishes to see a large increase in the white population of the country, in fact, we must all realize that it is a matter of vital importance that room be made for more white men and that every industry must do its share.

"The late Industrial Commission rightly laid it down as an essential condition before any industry could in future expect to receive protection through the Customs that it must show that it is using a fair proportion of white labour. Agriculture at the present time finds employment for more white labour than any other industry in the Union. Thousands of small farms in the country are run almost entirely by the farmer and his family, and those of us who have to employ a considerable amount of outside labour use the white man where we can and would do so more were more available.

SKILLED LABOUR.

"The old crude days of farming are passing; continually are we finding that one branch after another of our work must be done now by skilled labour if it is to be done at all, and I am sure that every farmer here would mournfully have to confess that he cannot get that required skilled labour from among our natives. How often do we hear the cry, 'Use improved and labour-saving implements!' and we think of that twenty-planter we sent out with our best native and that came back an hour after with two levers and three cog-wheels smashed; of a new mowing machine completely wrecked; of other up-to-date tools we have admired and would gladly purchase, but we dare not, as we know only too well we had no one we could trust to use them.

"Mr. Maurice Evans has told us that in his recent visit to the Southern States of America he found that the negroes there had every opportunity given them of becoming efficient workers, yet that even there the white worker was steadily driving out the black. That which they are finding, I believe, we shall find, and I am becoming daily more convinced that if we here in South Africa are to take our place in the van of producing nations, it can only be done by using up-to-date ways and methods that will necessitate a big increase of white labour to stiffen our unskilled native supply.

"The trouble, however, is to get such white labour; there is no doubt about our increasing need of it. Never in the history of Natal has the daïry industry looked more promising than it does now. Butter factories that were started a few years since with great trepidation are now well grounded and prosperous, while new ones are starting in several directions with good prospects of success. East Coast fever is now almost a thing of the past in Natal, but the difference its presence has made in our ways of cattle farming is marvellous. Fenced farms are becoming the rule instead of the exception; the dipping tank is now considered as necessary on a farm as a milking shed on all farms worthy of the name. The tick has now practically gone, and with it has gone the bulk of our cattle diseases.

"Every farmer in the country is now trying to improve his stock, and the stud breeders have a constant demand on their output, while the splendid offer of the Union-Castle Company to bring out pure-bred animals free of charge is resulting in a continual flow of fresh blood into the country.

"While the dairy industry is in this very satisfactory state, the stud breeder is, I consider, being most unfairly treated. It is true, as I have said, that he has had a large demand for his young stock, but as the demand is confined to Natal it does not anything like cover the animals he has for sale. Here, in Natal, he has to compete with stock from all the other Provinces of the Union pouring in on all sides under the slightest of restrictions, while he is debarred from sending a beast out of the Province. Were there any justification for this embargo on our cattle our breeders would accept the situation and pocket their losses as best they could, but we all know there is no justification. It is as safe to move stock from the farms of our chief breeders as from any other places in the Union. All parts of Natal have been restocked from such safe farms with no evil results whatever.

"A certain prejudice has grown up in other Provinces that because a beast comes from Natal, therefore there must be some risk of East Coast fever attached to it. The Agricultural Department knows perfectly well that the risk is now gone from most of our stud farms, but prefers rather to pander to the ignorant and political prejudices of other Provinces than to do justice to Natal.

"Stud cattle for the interior Provinces can be landed in Natal from overseas, be carried through Natal on our railways, and no objection be raised, but if one of our breeders wishes to rail a beast into the interior from a farm that has never had East Coast fever within miles of it, and whose whole district is now clean—an animal that has been regularly dipped all its life and that would be sent in a crate or special truck under the most careful regulations—to allow that might raise the prejudice referred to and possibly could be used to stir up some political feeling, so must, at all costs to our men, be forbidden, and no prospect of relief is held out to them. The whole position is so grossly unjust that I do not care to trust myself to say more on the subject. The matter will, however, be before you on the agenda, and I know others will have more to say.

TUBERCULOSIS.

"A large number of cattle have been tested for tuberculosis during the last twelve months, and the results show that the disease is more prevalent amongst Natal-bred cattle than was generally suspected, but at the same time it has been found mostly among herds where large importations of cattle from oversea had taken place.

"I understand that the question of dealing with this disease generally throughout the Union is under consideration, but, at the same time, the Agricultural Department is, as far as possible, prepared to apply the tuberculin test in any case where stock-owners so desire it. It is a very good sign that many farmers are making application for the services of the Government veterinary surgeons for this purpose.

"Horse breeding in the Province is still greatly restricted by the appalling ravages of horse-sickness, this year promising to be as bad or worse than last. The Veterinary Research Department is still experimenting with inoculation for this disease, and should the results of this season's work prove satisfactory, they hope to shortly make a big extension of their operations.

WATTLE INDUSTRY.

"Our wattle growers have had a very anxious year, and the future of the industry is by no means clear. Several attempts at considerable cost have been made here in Natal to make a wattle extract from the bark and so reach markets not at present open.

"So far, these attempts have not met with much success, and bark is still the only form of exportation. For bark our best and practically only market is Germany, for two reasons: The tanners of Germany use tanning pits which will take bark, not extract, and as a raw material bark is admitted into Germany free of duty. The output of bark is rapidly increasing, and will increase; not only are there thousands of acres of new plantations in Natal now coming into the market, but East Africa and India promise to soon be large producers also.

"A continually increasing supply into a restricted market must bring and keep prices down, apart from the fact that the buying at Hamburg is in the hands of a very close ring. Every effort is being made to open up fresh markets; a large consignment of bark is about to be shipped to America to enable the tanners there to prove its value. Till the tanning material in the bark can be placed on the market as an extract there is not much chance of doing business in England, as practically all tanning is done there now by extracts.

"Further efforts in this direction are being made, and it is hoped that we shall soon see a satisfactory extracting plant working in Natal. Relief is being sought in other directions also; by packing in compressed bales it is expected to save considerably on the shipping freight under the new shipping arrangements, and by a proper system of grading and selling the bark to grade, it is hoped to eliminate the losses now being made when selling. I am glad to say that very considerable reductions have been made in the railage of wattle timber, so that far more of this can now be disposed of.

"All industries get their ups and downs, and wattle has known the 'downs' before and has pulled through all right. One thing is certain, the men who have built up the wattle industry to what it is are among the most capable men in the country, and I have little doubt will see the industry round the present tight corner.

FIBRE INDUSTRY.

"After more than the usual number of initial difficulties, the fibre industry is reaching the producing stage, in fact, regular shipments are now being made. Only after many trials and failures has a machine been found that will properly handle our Natal-grown leaf, and the grit and perseverance shown by the pioneers in this enterprise is worthy of all praise. The world demand for fibre is a continually growing one; there are large tracts of country in Natal suitable for the growth of the aloe; good fibre now is worth, say, £30 a ton, so that given a way of manufacture at a reasonable cost, another most important industry will be opened up to the country. I am sure this Union is one with me in wishing every success to this new venture and in commending it to the Government for any assistance it can reasonably give.

"The output of sugar last year was not up to expectations owing to the drought. Hundreds of acres of cane gave no returns whatever,

and all felt the effect of the shortage of rain. This season promises much better. North and south coasts are seeing large additions of new land being brought under cane with new mills proposed or in course of erection; Mozambique is steadily increasing its output also, so that we must shortly see production exceed local consumption and an export trade in sugar started.

"In November last year delegates attended the meetings of the South African Agricultural Union held in Pretoria, and many matters of great importance to Natal were discussed there. The conference this year will be held in Natal, and it will fall to the incoming committee to see that Natal has a hearty welcome ready for the delegates from all parts of the Union. I am by no means satisfied that the South African Agricultural Union is yet filling the place it should, but it is easy to under-value the work it is doing, especially in finding a common ground upon which all classes and kinds of South African farmers can meet in unity and concord to discuss and deal with matters of common interest. Since we last met here the Cape societies have come into line with those of other Provinces and are now all represented in the central union.

"It was felt by your executive committee that the two great branches of industry in this Province—agriculture and commerce—had not in the past quite realized how much ground there was in common between them, that many problems of our country were common to both, so that though the time might not be ripe for an 'alliance,' yet we might easily try for an '*entente*.' To this end we invited the Associated Chambers of Commerce to send a representative here as a visitor that they may learn our point of view on many debatable matters, and we shall, I know, welcome an expression of theirs. Friction so often arises from misapprehension, harsh judgments from lack of knowledge, so that for agriculture and commerce to each understand the other's point of view would be a great gain apart from the greater benefit to be obtained when forces can be joined to obtain a common end.

CO-OPERATION.

"I am glad to say the spirit of co-operation is steadily growing among our farmers. That lusty child of our Agricultural Union, the Agricultural Co-operative Union, Ltd., has increased its membership from 600 last year to 900 this, and growing stronger every day. New fields of usefulness are continually opening before it; the latest is the formation of a centre to supply guaranteed seed maize to all parts of South Africa. Even now we are only dimly beginning to realize what co-operation can do for us; I am inclined to think our opponents realize it far more than we do ourselves.

"This last year has seen several new societies join our Union; to delegates from those societies and to all other delegates, on behalf of the executive committee, I give a most hearty welcome to-day. I trust this conference will be not only a very useful but also a very pleasant one. It is not every delegate who has been accustomed to speaking in public, yet I hope every one, including the one with the very least of such experience, will realize that his expression of opinion will be welcomed as much as any one else's, and that it is thoughts more than words that are of real importance. I beg to formally move the adoption of the executive committee's report."

THE RESOLUTIONS.

The Government's replies to the previous year's resolutions were then considered, after which the conference proceeded to discuss the new motions on the agenda paper. The following are the principal motions carried:—

Tuberculosis.

"That in the opinion of this Union full compensation should be paid for imported or otherwise cattle destroyed on reacting to tuberculin in which no tuberculous lesions can be demonstrated on post-mortem examination."—*Moved by Mooi River Farmers' Association.*

Movement of Cattle.

"That this Union desires to draw the attention of the Minister of Agriculture to the fact that tick-infested cattle are being introduced into the Province of Natal from other Provinces of the Union, and trusts that he will take the necessary steps to prevent any movement of tick-infested cattle."—*Moved by Royal Agricultural Society.*

"That this Union considers the restrictions at present in force totally prohibiting the movement of cattle from clean areas in Natal to other Provinces of the Union are unnecessarily stringent and unfair, and urges that application for the removal of pure-bred cattle (male and female) for stud or breeding purposes should, on the recommendation of the District Magistrate, District Veterinary Surgeon, and Chief Veterinary Officer of Natal, and subject to such precautionary measures as may be considered necessary by the Veterinary Department, be granted."—*Moved by the Rosetta Co-operative Farmers' Association.*

In connection with this resolution, the following rider, proposed by Sir Thomas Hyslop, was also passed, viz.: "That the matter be left to the executive committee."

Compulsory Dipping.

"That in the opinion of this Union compulsory dipping be enforced throughout the Province."

This was proposed by Mr. Mackenzie (representing New Hanover Agricultural Society) as an amendment to the following, introduced by the Sundays River Farmers' Association, viz.: "That in the opinion of this Union the compulsory dipping of cattle be enforced in this Province, and that a dipping inspector be appointed whose duties shall be to test the strength of the contents of all dipping tanks and to see that the dipping of cattle is properly carried out."

Rates on Wattle Bark.

"That in the opinion of this Union the Railway Department should be asked to reduce the rate of railway carriage of black wattle bark to the Point, Durban, and also on the short-distance rate when being sent to the mill to be cut and re-consigned."—*Moved by New Hanover Agricultural Association.*

Railway Storage Charges.

"That this Union take steps to urge the Railway Department to amend its regulations with regard to the charge for storage of goods at country stations."

This was moved by Mr. Geo. Hulett as an amendment to the following resolution introduced by the New Hanover Agricultural

Association: "That in the opinion of this Union the Railway Department should be asked to make no charge for the storage of wattle wood placed by consignors on loading banks at railway stations while the wood is lying there waiting to be loaded into railway trucks to be dispatched to the consignees of the same."

Handling of Perishables.

"That this Union desires to draw the attention of the Minister of Railways to the unnecessary exposure of perishable produce, especially cream and milk, at railway stations, and trusts that he will instruct station masters to place all perishable produce, especially cream and milk, in shade and shelter while waiting dispatch."—*Moved by Mooi River Farmers' Association.*

"That in the opinion of this Union the Railway Department should be asked to provide accommodation for the off-loading of wool in Durban, as at present wool is off-loaded in the open and valuable consignments have been damaged through being exposed to rain."—*Moved by Nottingham Road Farmers' Association.*

Extermination of Jointed Cactus.

EXPERIMENTS WITH ARSENITE OF SODA AND RADEMEYER'S PREPARATION.

Conducted by K. MELDAL JOHNSEN, Assistant to the Government Agriculturist at Hankey.

ONE of the densest spots covered with jointed cactus and shrub was selected for this experiment, each plot being half an acre in extent.

The first spraying was done on 1st November, 1912. Narrow footpaths had to be made every four or five yards to enable one to get in with the hand spray-pumps used.

The place was inspected at intervals, and one month after spraying nearly all the cactus in both plots appeared to be dead, but when examining the roots it was found that several, and those mostly young roots or bulbs, were still alive.

In several cases the bulbs were rotten, but with small healthy parts from which new joints were starting to grow.

This proves how difficult it is to exterminate the jointed cactus.

By the 12th December, the plots appeared to be burnt up, and on the 10th January, 1913, a second spray was applied to both plots. At the time of the second spraying, several young, healthy joints had made their appearance, specially in the arsenite of soda plot.

On the 3rd March, four months after the first spraying, the experiment was finally inspected. There were again occasional new growths in both plots, but considerably more in the arsenite of soda plot.

Roots were examined in both plots, and it was found that all older plants with big bulbs were completely dead, but that a small number of younger bulbs were still alive and had started growing again.

These few plants growing would have to be closely watched for a considerable time to completely exterminate the cactus, because they would be the means of reinfesting whatever area had been cleaned.

This experiment has proved that Rademeyer's preparation is more detrimental to jointed cactus than the 5 per cent. solution of arsenite of soda.

The following shows the cost per half acre of the two solutions:—

5 Per cent. Solution of Arsenite of Soda.

	£	s.	d.
First spraying, 1st November, 1912—			
6 Tins arsenite of soda at 2s. 6d. each	£0	15	0
1 Boy spraying 1 day	0	3	6
2 Boys to carry water, etc., 1 day each	0	5	0
1 lb. fat	0	0	8
Second spraying, 10th January, 1913—			
3 Tins arsenite of soda	0	7	6
2 Boys 1 day each	0	5	0
1 lb. fat	0	0	8
	£1	17	4

Rademeyer's Preparation.

	£	s.	d.
First spraying, 1st November, 1912—			
140 Gallons at 1d. per gallon	0	11	8
1 Boy spraying 1 day	0	3	6
2 Boys to carry water, etc., 1 day each	0	5	0
Second spraying, 10th January, 1913—			
60 Gallons at 1d.	0	5	0
2 Boys 1 day each	0	5	0
	£1	10	2

In comparing the two costs there is one point that must not be lost sight of, and that is that all stock must be kept away from the area where arsenite of soda has been used, owing to its highly poisonous nature. This is not necessary with Rademeyer's preparation.

The net results therefore show: (1) That Rademeyer's preparation destroys jointed cactus more effectively than a 5 per cent. solution of arsenite of soda; and (2) that the cost of eradication is cheaper when Rademeyer's preparation is used by seven shillings and two pence per acre.

Rural Notes.

Rinderpest in German East Africa.

At the annual conference of the Natal Agricultural Union held in Maritzburg in April, a condensed report of which appears in the present issue, Mr. C. Gray, Principal Veterinary Surgeon, addressed the meeting on the position in regard to the outbreak of rinderpest in German East Africa. On rising, he remarked that he had had no idea that this subject was going to be touched upon, otherwise he would have furnished himself with a map of the affected districts so that he might have made the position more clear than it was then possible for him to do. Information of the outbreak in German East Africa was received by the Union authorities some time ago, and the Governor-General suggested that the General Veterinary Surgeon for Rhodesia should be sent to German East Africa in order to ascertain from the German authorities precisely what the position was. That officer undertook the commission, and the German authorities gave him all facilities for informing himself on the subject. It seemed that rinderpest in German East Africa had extended from British East Africa, probably having been brought in from Masai. The disease must have infected the Masai cattle for some time previously. It appeared to have been carried across a belt of country. The disease had occurred in German East Africa four years ago, and it was curious that animals over four years of age had not added to the mortality amongst the cattle in the present instance. The German authorities had a well equipped veterinary department, but the great difficulty at the present time arose through the shortage of serum.

Arrangements were being made for the establishment of a serum station, Mr. Gray proceeded. They were depending upon the British East African authorities for serum. By means of a diagrammatic map Mr. Gray explained the position of the disease. There seemed little chance of the disease spreading except at a certain point, a district densely populated with cattle and with wild animals on the border of Northern Rhodesia. They had had a conference at Bulawayo at which representatives were present from British East Africa, Northern Rhodesia, Mozambique, Nyassaland, Portuguese East Africa, Belgian Congo, Swaziland, Basutoland, Bechuanaland Protectorate, and the Union. They went very carefully into a report prepared by the Veterinary Department, and considered an offer by British East Africa for the supply of reserve serum to be held in readiness for the disease. They also submitted certain suggestions with regard to the clearing of a portion of Northern Rhodesia of all cattle. The border of that territory was also to be cleared, as well as Nyassaland. In the event of the disease breaking through and getting down south their only chance would be the establishment of a station where serum would be made and stored. The British East African authorities hoped to be able to supply a lot of reserve serum to be kept in hand to be used in case of need. They were much better off now as regards veterinary

Plate No. LVI. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Mr. J. B. McDonald's Clydesdale Mare "May Bloom." First in Open Class for Clydesdale Mares, three years and over.

assistance in Africa than they were when the disease originally invaded South Africa in 1896. At that time they knew very little about the disease. They now knew a very great deal more. In the event of the disease coming down south it was proposed that a policy of co-operation be adopted by the various States concerned, special officers being detailed for the work. The case called for united action. The disease might not come, but the position of the present outbreak was certainly grave, and gave rise to a certain amount of apprehension. Mr. Gray concluded by saying that he had every reason to believe that the recommendations of the Bulawayo Conference would be adopted by the various Administrations concerned.

Foot-and-Mouth Disease.

The British Board of Agriculture are calling attention to the possible risk of foot-and-mouth disease being introduced into Great Britain by means of hay and straw used for the packing of foreign imported goods. This question was considered by the departmental committee appointed by the president of the board to inquire into the foot-and-mouth disease in Great Britain. In their report the committee pointed out that numerous imported articles are packed in hay or straw, and that a large proportion of this packing ultimately reaches the farm as manure. The committee considered that this packing constitutes a source of danger, but in view of the serious dislocation of general trade which the prohibition of its use would entail, they were not prepared, unless there is further evidence, to advise such a course. The committee, however, recommended that persons using such hay and straw should be warned of the element of danger which it contains, and of the risk of allowing it to come in contact with any animals; they also advised that where possible it should be burned. The board hope that, with a view to minimizing the risk referred to, manufacturers and traders and all who receive hay and straw used for the packing of foreign imported goods will take the necessary steps to prevent this packing material being sent to farms or other places where it can come into contact with live stock, and will make arrangements for the burning of such material.

Animal's Weight by Measurement.

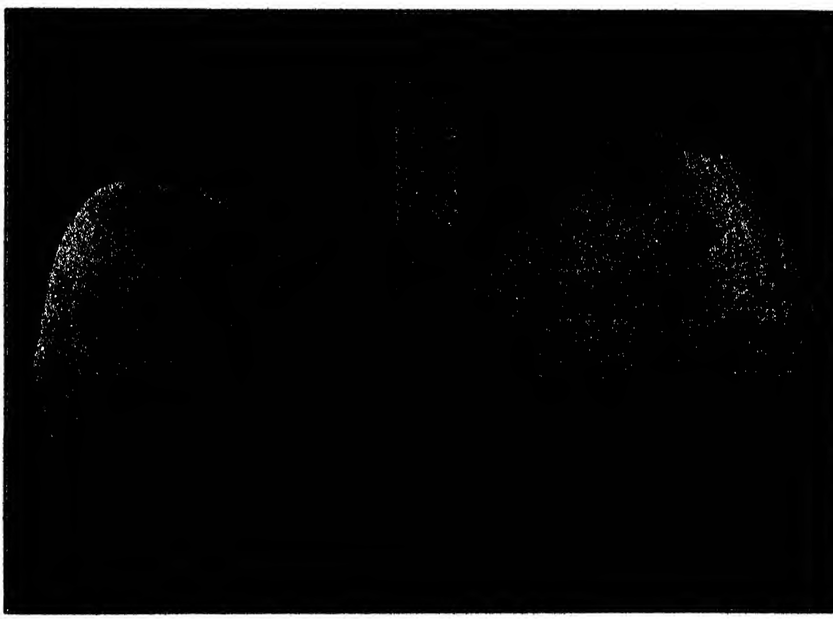
In reply to a request by a correspondent for information as to the best means of ascertaining the weight of animals by measurement, the Lecturer in Agriculture and Stock at the Grootfontein School of Agriculture writes:—The length of an animal is taken straight along the back from the square of the shoulder to the square of the buttock and the girth immediately behind the shoulder. Rule 1.—(Girth) 2 × .5 length divided by 21 gives weight in imperial stones. Measure in feet. Rule 2.—(Girth) × length × one of the following decimals; strike off to the right as many points as are contained in the decimal; result is imperial stones. Measure in feet. Decimals applicable to different animals:—

Moderately fat	.23
Fat	.24-.25
Prime fat	.26
Very fat	.27

With the help of the two above rules, the dressing percentage or butcher's carcass is obtained. As the dressing percentage of fat animals varies from say 55 to 62 per cent. according to condition and quality, etc., of animal, the live weight of animal can be easily figured from that.

Keiffer Hybrid Pears.

Early in April we received a visit from Mr. J. Horrocks, of the Government Printing Works, Pretoria, who brought with him some fine specimens of a pear of the Keiffer Hybrid variety, grown by him at Villieria, one of the suburbs of the Administrative Capital. A



KEIFER HYBRID PEARS.
Two fine specimens grown by Mr. J. Horrocks, at Villieria, Pretoria.

photograph of two of these is reproduced herewith. The two pears here depicted turned the scale together at three pounds. Mr. Horrocks informed us that he was induced to take up the Keiffer Hybrid variety by an article which appeared in the *Transvaal Agricultural Journal* some seven or eight years ago. He imported a number of trees, but, unfortunately, only a very small number turned out to be the variety he was after. The valley in which Villieria is situated is regarded as being unfit for fruit culture, but Mr. Horrocks' experience should serve to dispel this evidently erroneous notion. It may be added that the pears shown in the photograph were not specially selected; in fact Mr. Horrocks informed us that he had had larger ones, but quite a number had been stolen by the inevitable "small boy." We wish Mr. Horrocks all success in the future.

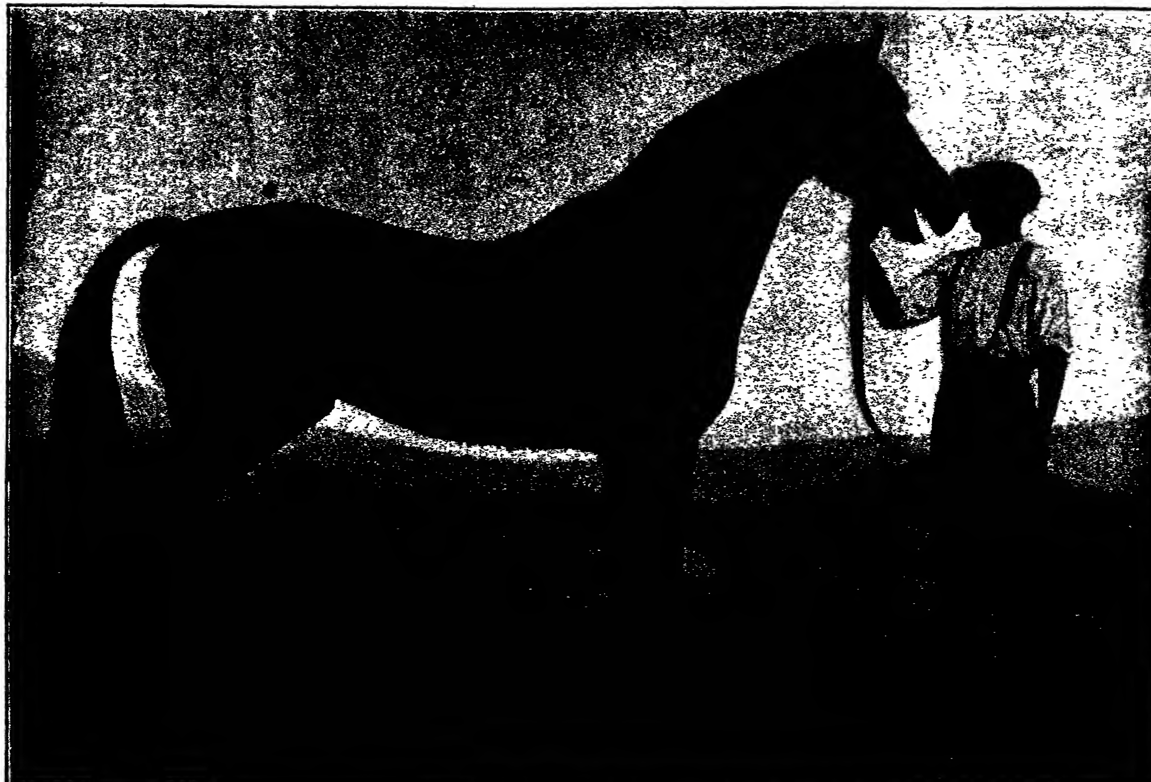


Plate No. LVII. WITWATERSRAND SHOW. *Photo by J. Austin Hughe*

The Department of Agriculture's Thoroughbred Stallion "Valiant," from Tweespruit Farm. Second place in Open Class, eight years and over.

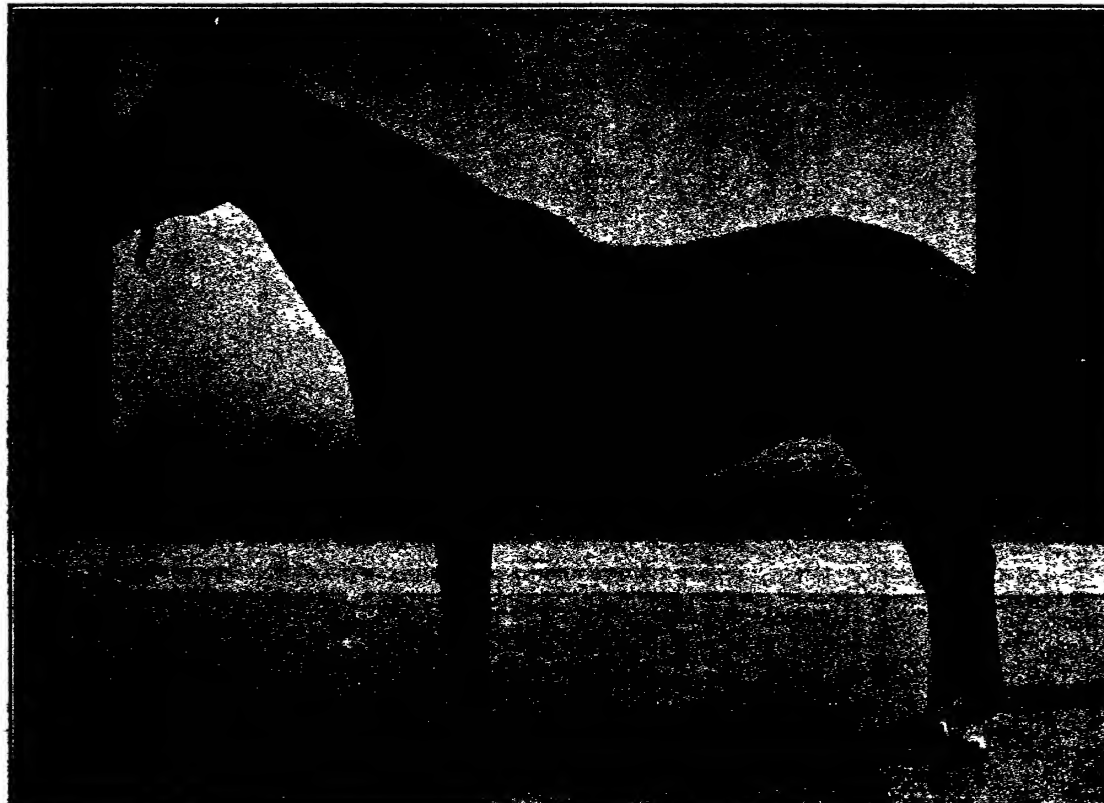


Plate No. LVIII. WITWATERSRAND SHOW. *Photo by T. Brittain.*

The Department of Agriculture's Thoroughbred Stallion "Wilkins Micawber," from Tweespruit Farm. Champion Stallion, and First in Open Class, eight years and under.

Selecting Seed Maize.

The importance of carefully selecting maize for seed purposes is a matter which is too often overlooked. Every season many farmers discover too late that their seed corn either fails to germinate or produces but a weak growth, and this factor is responsible for quite an appreciable difference, not only in the total crops of the country, but also in the crop of the individual farmer. With very few exceptions the best possible seed may be selected on the farm on which it is to be planted, and by carrying out the following instructions issued by the Office of Corn Investigations of the United States Department of Agriculture, each farmer may provide himself with an abundance of seed of the highest productivity for planting next season. The process of seed selection is of too great importance to be conducted incidentally while husking. As soon as the crop ripens, go through the field with bags and husk the ears from those stalks which have produced best without having had any special advantages, such as extra space, moisture, or fertility. Late maturing plants with ears which are heavy because of an excessive amount of sap should be ignored. Other things being equal, short, thick stalks are preferable. These permit of thick planting, are not so easily blown down, and are usually more productive than slender ones. The tendency to sucker is hereditary. Other things being equal, seed should be taken from stalks having no suckers.

The same day that the seed maize is gathered the husked ears should be put in a dry place where there is good circulation of air, and placed in such a manner that the ears do not touch each other. If no previous arrangement for caring for the seed has been made, the ears may be suspended with binder twine, tying them about two inches apart. The twine will support fifteen or twenty ears. If this method cannot conveniently be followed, tables may be improvised by placing boards across boxes or barrels. These boards should be dry and not too wide, and should be spaced 1 inch or 1½ inches apart. The seed ears can be put on these tables, using care to have them spread out to ensure a good circulation of air among them. It will be advisable to move the ears a couple of times at intervals of about two days. when first put on the tables; whichever method is used the seed should be placed in a shed or building having a good circulation of air, and where it will be protected from rain and excessive cold, as well as from rats and mice. Do not store seed in a cellar. The driest cellars are too damp and do not afford a free circulation of air. Do not store seed in a room in which there will be vapour to condense on it and prevent its drying, as in a barn over stock, or in an outbuilding used for washing. If seed maize is stored properly it should be thoroughly dry in from three weeks, and if kept dry it will be safe from injury except by insects and vermin. By the proper selection and care of seed maize the yield may be greatly increased with but a slight additional expense. Increases of 18 bushels per acre, due to properly preserving the seed, have been obtained.

A "Perfect Potato."

The *Rural New Yorker* has a note on what it describes as a well-nigh ideal eating potato, called the Pride of Vermont, and grown by Mr. Geo. E. Burdett, of Windsor County, Vermont, U.S.A. He

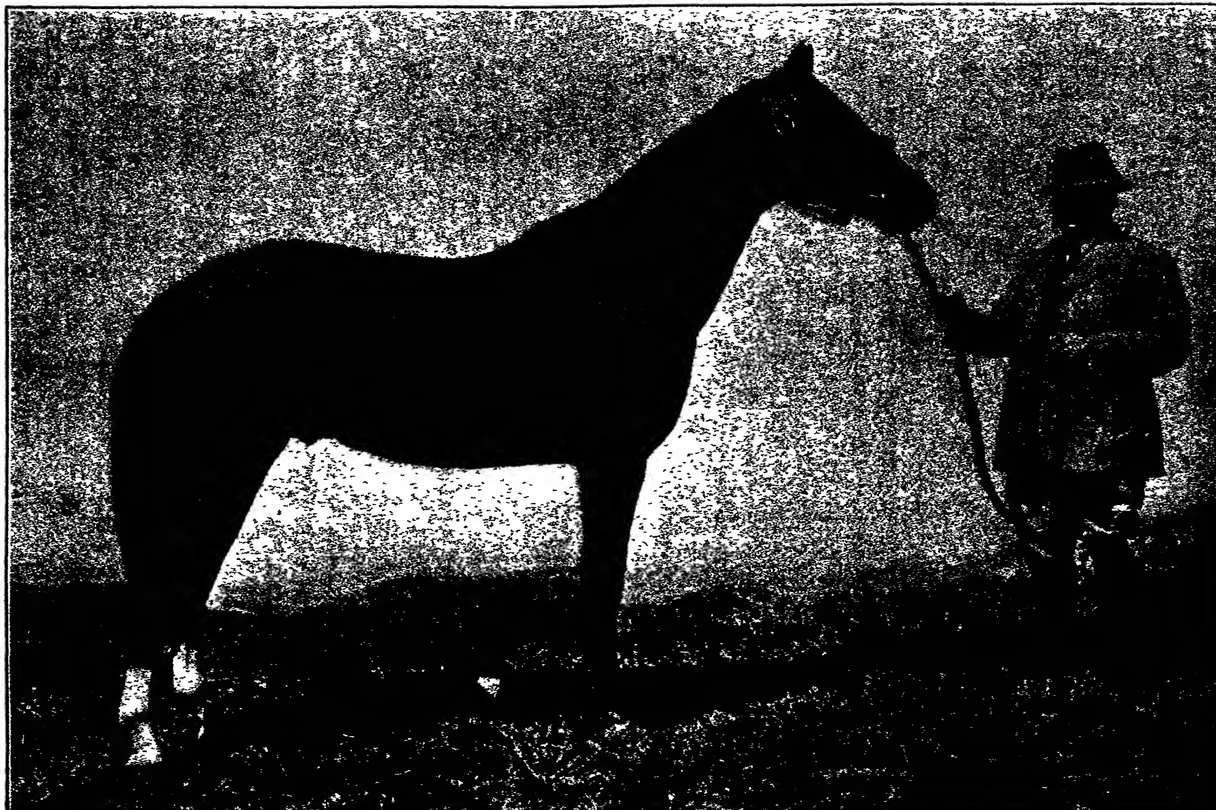
obtained a yield of 527.2 bushels on a measured acre. Of this yield 11.6 per cent. ranked as "small" tubers, or under four ounces in weight, while 14.9 per cent. were "large." This left 73.5 per cent. between 4 and 12 ounces, or the best cooking size. These potatoes gave an average analysis of 16.65 per cent. of starch, and, as might be expected, cooked out dry and mealy. Mr. Burdett says: "I think the best way to produce medium-sized, high quality potatoes is to select the seed from hills having a good number of smooth, medium-sized potatoes, cut them in three to five pieces, so that each piece will contain two to four good eyes, drop them about a foot apart, and cover them quite deep. . . . By seeding more heavily and using more fertilizer I think the yield is better, as well as the potatoes more uniform in size."

Dry-Cut Silage.

An interesting letter appears in a recent issue of the *Breeder's Gazette* regarding the use of dry-cut material for ensilage making. It happened that before the filling of the first silo could be started, the maize was quite ripe and dry; the ears had white husks, and the lower blades on the stalks were dead. Before the filling of the second silo commenced a killing frost was experienced. Correspondent writes: "The silage as it dropped from the blower was so dry and feathery that it would not pack in the silo. We then hitched our 1½ horse-power gasoline engine to the force pump at the barn well and delivered a 1-inch stream of water through 60 feet of inch well-pipe and rubber hose up into the silo. One man inside walked about carrying the conveyor and the hose with the stream of water, and a second man with a fork levelled down any bunches and tramped and packed the silage from the bottom to the finished layer on top. The inch stream of water was forced into and over the silage during all the filling, requiring a little over two days. This silage is now being fed out to milk cows, fattening steers, stock steers, and cows, fattening lambs, stock ewes, horses, and brood sows. It is relished by all of them. The silage is in the finest possible condition, with no mould and no burnt spots, and it is neither too acid nor bitter. In future fillings of the silos we shall very much prefer the corn over ripe than greenish, if we can have plenty of water to soak the silage down at the time of filling."

Farm Pupils.

The Government Secretary of the South African National Union writes: "While admitting, as every one does, that existing conditions in South Africa make impossible the introduction of emigrants on a large scale, the South African National Union has long realized the urgent necessity for altering the present proportions of our white and coloured population. It was felt some years ago that a beginning in this might be made by getting from oversea a number of youths who wished to take up land here, and who would first go through a preliminary practical training on a South African farm, followed probably by a short theoretical course at one of the local agricultural colleges. A long list was compiled of farmers willing to take such pupils, but the scheme came to nothing at the time, because it was found that men demurred at the payment of the premium asked, in view of the fact



ate No. LIX. WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Messrs. Haggett & Ovens' Colt "Amorist," 1 year 6 months, by Kooma—Miss Flax. Bred by Exhibitors.

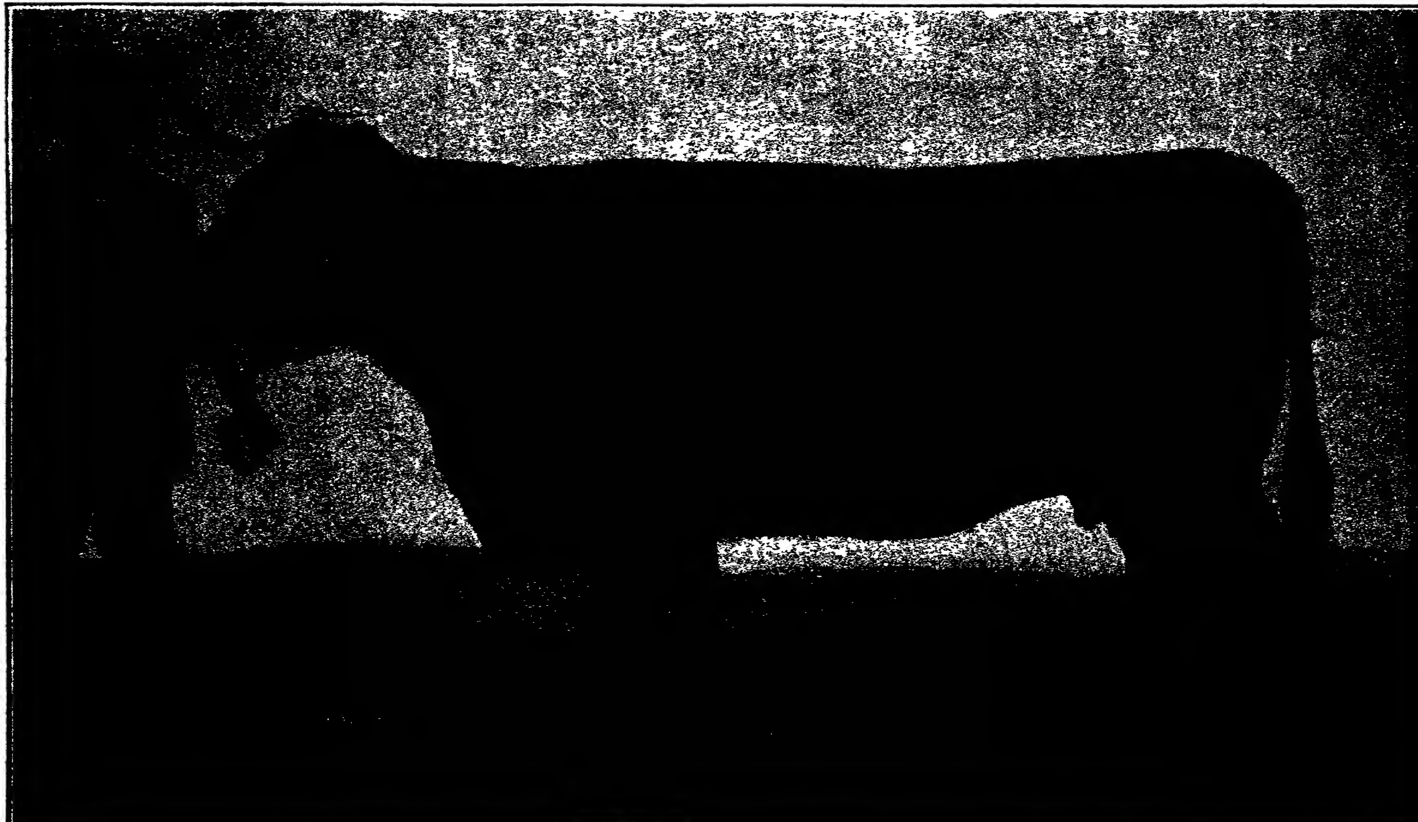


Plate No. LX. WITWATERSRAND SHOW. *Photo by J. Austin Hughes*

Potchefstroom Experiment Farm's Shorthorn Cow "Stenigot Gwynne XIII."

that similar atractions were offered free by other countries. In the interval the views of farmers on this point seem to have changed, for a considerable number have lately expressed their willingness to take pupils without payment, provided they undertake to give work in exchange. The increased use of valuable implements and machinery on the farm, of course, makes a large number of responsible white men an absolute necessity, and these pupils should soon be able to supply that need.

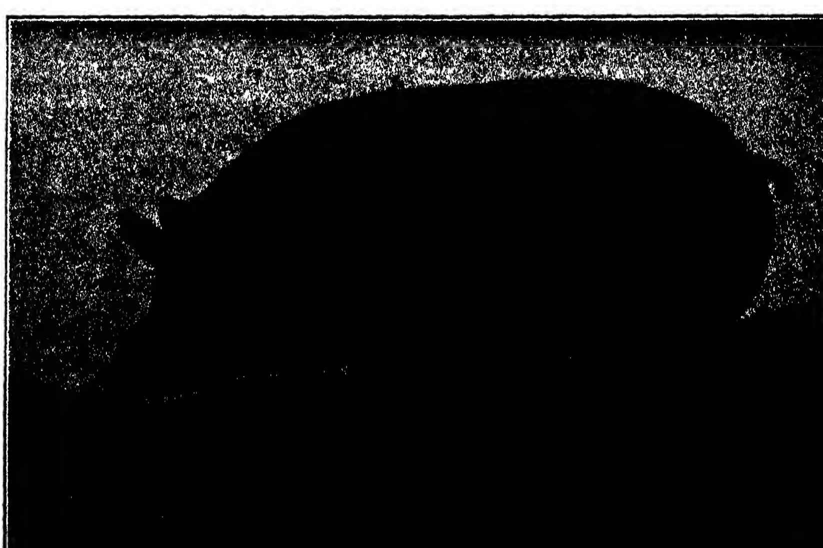
"Although experience has shown that it is not so easy to attract the right class of man to South Africa, even a limited number of young fellows who desire to eventually take up farming in the Union will be a valuable addition to the population of this country. The line on which the work is to be undertaken is that no premium will be offered, labour being given in exchange for board and lodging for, say, one year, with the prospect of a wage or interest afterwards. The class to be sent out will be educated youths of the middle class, between the ages of 18 and 25, it being realized that this class is likely to provide the most suitable men for the purpose. It must be remembered that other countries are offering exceptional attractions to able-bodied men of all classes, some even inviting children, and it is therefore useless to expect men to pay in this country for what they can get free of charge in other parts of the world. The S.A.N.U. now appeals to farmers in South Africa to assist in this movement, and it asks for the names of farmers willing to take pupils on the terms mentioned. Although a few have already been secured and successfully placed no guarantee can be given at present that pupils will be forthcoming, but an organized attempt will be made to obtain them. It is proposed to recommend that these young men stay at least two years on a farm, then go through a course of instruction at one of the agricultural colleges here, followed by further period of practical training on a farm. The Secretary of the S.A.N.U., 20 Cullinan Buildings, Johannesburg, will be glad to hear from farmers in any part of the Union, but preference will be given to applications from the middle and high veld districts of the country. The wisdom of this will be admitted."

Port Elizabeth Show.

At the beginning of April the Port Elizabeth Agricultural Society held its 49th Annual Exhibition in glorious weather. Regarding it as a whole the show constituted a record for Port Elizabeth, whilst it maintained the high position which the Port Elizabeth Exhibiton has come to hold in the South African Show Calendar. The entries in the horse, cattle, and sheep sections were remarkably numerous, so much so indeed that the existing accommodation had to be increased. De Beers alone, for example, were responsible for over 50 horses. There were roughly some 250 entries in the cattle section, representative of all the leading breeders in the country. Shorthorns were probably the strongest class, but these were run very close by the Frieslands. In the horse section also there were over 250 entries, and this feature of the show certainly constituted a recrod. Sheep and goats surpassed all records, and there were hundreds of animals, all of the best blood

WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Mr. H. D. F. Nelson's "Buttercup." First in South African Bred Class for Channel Island Cows, three years and over.



WITWATERSRAND SHOW. *Photo by J. Austin Hughes.*

Mr. J. Gunning's Tamworth Sow. Winner of First and Second Prizes in South African Bred Class.

Plate No. LXI.

in the country. Pigs formed a very small section as usual (with only thirteen entries), but such animals as there were were good. Poultry were well represented. There was a splendid show of wool and feathers. The first prize cup and medal for the best entire plucking of unsorted feathers of twenty ostriches were awarded to Mr. J. A. Meiring, whilst Mr. B. E. White was winner in the class for the best variety of ostrich feathers in less than 5 lb. in all, and to be of no more and not less than fourteen distinct kinds of not less than 6 oz. of each of thirteen specified classes of feather. Other sections of the exhibition showed up well, and altogether the society is to be congratulated upon a most successful function which well upheld—and in some directions surpassed—the high standard in former years.

Miscellaneous Notes.

The attention of readers is called to the notice which appears at the end of this issue regarding the supply of trout, carp, and tench fry for the stocking of streams. It will be seen that applications for fry must reach the Curator of the Trout Hatchery at Stellenbosch not later than the 31st August. Full particulars regarding price, method of procedure, etc., will be found in the notice.

Mr. A. White, of Hillcrest Dairy Farm, P.O. Box 616, Pretoria, has supplied us with the milk record of one of his cows, "Jenny," a Cape and Fries cross. During the period 5th June, 1912, to 29th March, 1913, this cow produced 1238 gallons. The greatest quantity of milk supplied in a single day was 55½ pints. Mr. White informs us that "Jenny" had no special feeding, and has been running with other cows in the veld and fed night and morning.

We have lately received several unsigned letters from readers of the *Journal*, a *nom de plume* only being used. We would remind readers that no notice can be taken of such letters, and that, if a *nom de plume* be used for publication purposes, the writer's name and address must also be enclosed. We have by us letters signed "Interested," "A.S.," and "Cela," respectively, but with no indication as to their source. If these correspondents will send us their names and addresses replies will be forwarded to them. Will "W" also please communicate with us at an early date.

Notes from the Schools of Agriculture and Experiment Stations.

IMPORTATION OF PURE-BRED STOCK.

The pure-bred stock recently imported by the Department of Agriculture has been distributed as follows:—

Horses.

Potchefstroom School of Agriculture.—1 hackney stallion, 1 thoroughbred stallion, 1 Percheron stallion, 2 Percheron mares.

Grootfontein School of Agriculture.—2 hackney stallions, 1 Oldenburg stallion, 3 thoroughbred stallions, 1 Percheron stallion, 4 Percheron mares.

Elsenburg School of Agriculture.—2 hackney stallions, 1 thoroughbred stallion, 1 Percheron stallion, 3 Percheron mares.

Standerton Stud Farm.—1 hackney stallion, 3 thoroughbred mares, 2 Clydesdale mares.

Tweespruit Stud Farm.—1 Oldenburg stallion, 2 thoroughbred stallions, 1 Clydesdale stallion, 3 thoroughbred mares.

Roodepoort Experimental Farm.—2 Percheron stallions, 3 Clydesdale mares.

Cattle.

Cedara School of Agriculture.—Dairy Shorthorns: 1 bull and 14 cows; Ayrshires: 1 bull and 9 cows.

Potchefstroom School of Agriculture.—Red Lincolns: 1 bull; Ayrshires: 1 bull and 3 cows; Sussex: 1 bull.

Grootfontein School of Agriculture.—Dairy Shorthorns: 1 bull and 8 cows and heifers.

Elsenburg School of Agriculture.—Jerseys: 1 bull.

Ermelo Stud Farm.—Aberdeen-Angus: 1 bull.

Pigs.

Cedara School of Agriculture.—Large Black: 1 boar and 2 sows; Berkshire: 1 boar and 2 sows.

Potchefstroom School of Agriculture.—Large Black: 1 boar and 3 sows; Berkshire: 1 boar and 3 sows.

Elsenburg School of Agriculture.—Large Black: 1 boar and 2 sows; Berkshire: 1 boar and 2 sows.

Tweespruit Stud Farm.—Large Black: 1 boar and 1 sow; Berkshire: 1 boar and 1 sow.

Sheep.

Standerton Stud Farm.—Suffolk: 1 ram.

Additional accommodation for stallions is now being provided at Cedara, Grootfontein, and Elsenburg, and as soon as it is completed a number of stallions will be transferred from other institutions to these three places.

In connection with the cattle, it is interesting to note that this is probably the first shipment of Dairy Shorthorns (Coates) made to South Africa. The suitability of this breed to South African conditions will be tested by the establishment of two herds, one at Cedara, Natal, and the other at Grootfontein, Middelburg, Cape Province.

The bulls were purchased from the famous herd of Lord Rothschild at Tring, Hertfordshire; some of the cows and heifers came from the same herd and some from the herd of Messrs. R. W. Hobbs & Sons.

Thirty-two Friesland cows and heifers and two bulls intended for Grootfontein, Potchefstroom, and Ermelo institutions are now on the water and are expected to arrive about the middle of May.

A small lot of Ayrshires, which have recently been increasing in favour in Natal and other parts of the Union, has been purchased for the Cedara Farm.

STUDENTS AT AGRICULTURAL SCHOOLS.

With the exception of Elsenburg all accommodation for students is fully occupied—indeed in most cases the number of applications for enrolment of students is far in excess of the number for which accommodation is available.

At Grootfontein 87 students were enrolled at the beginning of this year, at Potchefstroom there were 66, at Cedara 30, and at Elsenburg there are now 20 students in residence—a total of 203.

SCHOLARSHIPS FOR AGRICULTURAL STUDY ABROAD.

The following gentlemen were awarded scholarships and have proceeded or will shortly proceed oversea for courses of special study at approved institutions :—

Messrs. D. C. Malan, M.A., and E. Cogan, B.A., Economic Entomology; Messrs. J. C. Ross, B.A., and J. P. van Zyl, B.A., Agricultural Chemistry; Mr. J. C. van der Lingen, Agricultural Engineering.

STAFF CHANGES.

The personnel of the staffs at the different schools and experiment stations has been considerably increased in order that educational, research, and experimental work may be more ably executed. The following alterations in staff have taken place during the last two months :—

Grootfontein.—G. C. G. du Toit, mechanic, resigned; A. W. Mitchell, mechanic, appointed; W. R. S. Ladell, lecturer in chemistry, resigned 24/2/13.

Cedara.—E. Baker, lecturer in botany and forestry, appointed 16/4/13.

Elsenburg.—W. Johnston, carpenter, appointed 10/2/13.

Potchefstroom.—A. Reid, farm manager, resigned to take up appointment as manager of the Mushroom Valley Estate, Orange Free State; T. B. Cross, poultry manager, appointed 22/3/13; F. L. Walker, poultry manager, resigned 28/2/13.

Standerton.—G. V. S. Tate, acting as manager during absence of A. McNae on leave.

Grootvlei.—M. S. de Kok, poultry assistant, resigned 3/4/13; Roberts, poultry assistant, appointed 10/4/13.

Short Courses of Instruction at Potchefstroom and Elsenburg Schools of Agriculture.

SHORT courses of instruction specially designed for young farmers and farmers' sons will be given during the winter vacations as follows:—

AT THE SCHOOL OF AGRICULTURE, POTCHEFSTROOM.

From 7th July to 1st August (inclusive). Students may take up residence on 5th July. Lectures will begin at 9 a.m. on 7th July.

Subject.	*Lecturer.*
LIVE STOCK.—Breeding and Management; Judging	E. H. Macmillan, B.S.A.
SHEEP.—Merino Sheep, Breeding and Management; Wool Classing	A. Spies.
FARM CROPS.—Tillage and Seeding; Harvesting and Judging Farm Produce	H. Thompson, B.Sc., F.C.S.
Feeds and Feeding	A. M. Bosman, B.S.A.
TOBACCO AND COTTON.—Culture, Curing, and Marketing of Tobacco; Culture and Ginning of Cotton	W. H. Scherffius, M.S.
VETERINARY SCIENCE.—South African Diseases and their Prevention and Curative Treatment; General Diseases among Farm Animals, Symptoms and Curative Treatment	J. Quinlan, M.R.C.V.S.
AGRICULTURAL ENGINEERING.—(*a*) The Design and Construction of Dams and Small Irrigation Works; (*b*) Farm Buildings; The Principle and Action of Steam, Oil, and Gas Engines ...	W. S. H. Cleghorne, B.Sc., A.M.I.Mech.E.
DAIRYING.—The Treatment and Care of Milk; Butter-making; Milk Testing; Milk Records...	J. B. Fisher, N.D.D.
POULTRY.—Management and Rearing	R. Bourlay.
HORTICULTURE.—Orchard Cultivation and Management; Grafting and Pruning	W. A. Sturm.
AGRICULTURAL CHEMISTRY.—Soils and Soil Fertility; Composition, Uses, and Valuation of Manures	T. G. W. Reinecke, B.A.
AGRICULTURAL BOTANY.—Some Plant Diseases and their Control; Maize Breeding; Winter Pasture Plants	T. O. Bell, B.A.
ECONOMIC ENTOMOLOGY.—Insect Pests and their Control	W. Moore, B.A.

The following are conditions governing admission to this course:—

(1) Candidates must be over 18 years of age.

(2) The fees are £5 inclusive of instruction, board, quarters, and laundry, and are payable in advance.

(3) Testimonials showing that the candidate is of good moral character must be submitted with the application. He must also be sound in health.

(4) By making application for admission, each candidate will be deemed to have undertaken to abide by and conform to all the rules of the institution.

(5) The whole course of instruction as arranged by time-table must be attended. Exemption from any subjects will not be given.

Concession certificates entitling the holder to travel to and from Potchefstroom at the reduced railway fare of single fare for the double journey will be issued to those attending the course. If necessity arises, preference may be given to farmers and farmers' sons; the application should, therefore, give such information as well as the present occupation of the applicant.

Applications should be made before the 13th June to the Principal, Potchefstroom School of Agriculture, Potchefstroom, from whom any further particulars may be obtained.

AT THE SCHOOL OF AGRICULTURE, ELSENBURG, MULDERS VLEI, CAPE PROVINCE.

COURSE FROM 16TH JUNE TO 28TH JUNE.—HORTICULTURE AND VITICULTURE.

HORTICULTURE.—(1) Establishment of the Orchard, including (*a*) choice of site, preparation of soil, (*b*) laying out of the orchard, and (*c*) choice of trees and care of the young orchard.

(2) Maintenance of the Orchard, including (*a*) cultivation, pruning, and training of trees, (*b*) manuring (green and other), (*c*) rejuvenating old orchards, and (*d*) grafting and budding.

(3) Insect Pests and Fungoid Diseases and best ways of combating them.

(4) History and Methods of Caprification of Figs.

VITICULTURE.—(1) Establishment and Cultivation of a Vineyard, including site for vineyard, preparation of soil, laying out of vineyard and planting out of vines; cultivation of vineyard, winter pruning and systems of trellising; summer treatment of vines (topping, non-setting of berries, thinning out bunches, defoliation, etc.)

(2) American Stocks.

(3) Principal Varieties of Table and Wine Grapes.

(4) Manuring of Vines. The different manures, their specific functions, mixing after certain formulae.

(5) Vine Diseases. Their diagnosis and treatment.

COURSE FROM 30TH JUNE TO 12TH JULY.—AGRICULTURE AND STOCK, POULTRY, DAIRYING, AGRICULTURAL CHEMISTRY AND AGRICULTURAL BOTANY.

AGRICULTURE.—(1) Soils, types of, formation, general properties, plant food, improvement of soil by cultivation, manuring and drainage, conservation of moisture by cultivation.

(2) Manures.—Composition, valuation, mixing, and application; reasons for different crops and soils, liming, green manuring, and farm yard manures.

(3) Crops.—Preparation of land, sowing and planting, cultivation, harvesting, marketing, rotations, uses of and types suitable for Western Province or South Africa, making of hay and ensilage.

ANIMAL HUSBANDRY.—Foods and Feeding.—Composition and properties of foodstuffs; the relation of food to the production of work, fat, milk, and the increase of body weight; rations suitable for different classes of stock.

Principle of Breeding.—Use and abuse of pedigree, importance of well-bred sires; pure-bred, cross-bred, and grade animals.

Farm and Stock.—Utility points in different classes of stock; general management, rearing and feeding of stock.

POULTRY.—(1) How to lay out a Poultry Farm.—Construction of runs and houses, approximate cost, etc.

(2) Best Breeds as Layers.—How to select and maintain these qualities.

(3) Best Breeds for Eggs and Table.—The dual purpose fowl.

(4) Ducks, all breeds.—How to manage them successfully.

(5) Geese and Turkeys from a farmers' point of view.

(6) South African Grain.—Its value as a poultry food.

(7) Incubators.—Their construction, handling, and uses; artificial *versus* natural incubation.

(8) Artificial Breeders and how to make and manage them.

(9) Killing and Trussing Poultry for home markets.

(10) Testing, Grading, and Packing of Eggs for near and distant markets.

(11) Poultry Diseases, their causes and cures.

DAIRYING.—(1) Lectures. Milk.—Its composition and secretion, care and cooling of milk, pasteurizing, milk testing, and milk records.

Cream.—Composition, separation and the working of separators; cream for butter making, cream ripening and the use of starters; cream cheese.

Butter.—The churning, washing, briming, salting, and working of butter.

(2) Practical Demonstrations.—Pasteurizing and cooling of milk and cream, cream separating, cream ripening and the care and use of pure culture starters; the making, washing, salting, and working of butter; the making of cream cheese.

The following are conditions governing admission to these courses:—

(1) Candidates must be over 18 years of age.

(2) The fees are £2. 10s. for each course inclusive of instruction, board, quarters, and laundry, and are payable in advance.

(3) Testimonials showing that the applicant is of good moral character must be submitted with the application. He must also be sound in health.

(4) By making application for admission, each candidate will be deemed to have undertaken to abide by and conform to all the rules of the institution.

(5) The whole of each course of instruction as arranged by time-table must be attended. Exemption from any subjects will not be given.

Concession certificates entitling the holder to travel to and from Mulders Vlei at the reduced railway fare of single fare for the double journey will be issued to those attending the courses. If necessity arises, preference may be given to farmers and farmers' sons; the application should, therefore, give such information as well as the present occupation of the applicant.

Application should be made before the 7th June to the Principal, Elsenburg School of Agriculture, Mulders Vlei, Cape Province, from whom any further particulars can be obtained.

ALEX. HOLM,
Under-Secretary for Agriculture.

Pretoria, 7th May, 1913.

Correspondence.

This section will be set aside for correspondence on all subjects affecting the Farming Industries of the Union of South Africa and cognate matters; and, while every reasonable latitude will be allowed, contributors are requested to be as concise and succinct as possible in the expression of their views.

Suggestions for practical consideration and discussion, and hints as to improved methods applicable to any branch of agriculture, will be particularly welcome.

It must at all times be distinctly understood that the Department of Agriculture is in no sence responsible for the views and opinions expressed in this section.

All communications should be clearly addressed "The Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria," and written on one side of the paper only.

LAMZIEKTE EXPERIENCES.

To the Editor of the *Agricultural Journal.*

SIR,—Kindly allow me a small space in your valuable journal. Much has been written with regard to gal-lamziekte, but until now no remedy has been found. I have had experience with gal-lamziekte since 1885. Since then I have noticed that transport oxen, constantly travelling from one place to another, were not subject to it, but that cows which stayed on one farm and which had no natural "brak," were subject to it. The transport oxen going from one district to another get sufficient natural brak and consequently no lamziekte.

Some farms have more brak than others, and many have no brak at all. On such farms the disease is usually very bad. I have in all these years never heard that cattle died on farms well supplied with natural brak. Cattle do not eat salt, even when prepared, when they can get natural brak. It is very remarkable that in this district no cattle die on farms where brak exists, only on farms where no brak is found. For the last twenty years I have kept from 500 to 600 cattle on a farm known for its natural brak and have not lost one through lamziekte in all this time. If draught oxen or any other cattle are taken into the Kalahari, where no brak is found, they begin to lick the riems. This shows that they must have brak. They have never been given salt. If

kept there for a long time they undoubtedly die of lamziekte. It is known everywhere in the Cape Province that cattle do not die of lamziekte where they get natural brak. In the very dry seasons when brak does not grow, lamziekte is worse and more spread. The principal braks are brak slaai, ganna brak, vaal brak, gno brak, and several other kinds of ground brak, viz., klipzweet. "Grond brak" is the principal brak in Damaraland. It would be a good thing if such an expert as Dr. Theiler could examine these different braks. Salt has not got the same effect on cattle as natural brak. Everything proves that lamziekte is not caused by something eaten by cattle, but by something they do not eat. After a careful research it will be ascertained of what the natural brak consists, and then it will also be known what the animal wants. I quite agree with Dr. Theiler that this disease is not contagious.—Yours, etc.,

C. F. LE RICHE.

Rietfontein, Gordonia, Cape Province.

APPLICATION OF BASIC SLAG.

To the Editor of the *Agricultural Journal.*

SIR,—As I am about to put in my winter oats and intend fertilizing the crop with "basic slag"—about 200 lb. per acre—will you kindly advise me whether it will harm the growing crop and whether I will be getting full benefit from the above fertilizer if I apply it in September just before the rains.

Also, is there anything to be gained by applying the "basic slag" before seeding?

Thanking you in anticipation,—Yours, etc.,

E. H. VERNON.

Carolina, Transvaal.

[The Lecturer in Chemistry of the School of Agriculture, Potchefstroom (Mr. T. G. W. Reinecke), replied:—The best time to apply basic slag to a crop, as in your case, is at the time of sowing. The seed and fertilizer can conveniently be harrowed in together. I should prefer applying the fertilizer before sowing than a month or two after, since basic slag is a comparatively slow-acting phosphatic manure. To apply it in September, when the seed was sown in March or April, would certainly mean that the crop would not get the full benefit of the manure. Basic slag, generally speaking, gives its best returns the second or third year of continued application.]

PROTECTING GRAIN AGAINST WEEVILS.

To the Editor of the *Agricultural Journal.*

SIR,—I am anxious to have advice as to the best means of protecting bagged cereals (maize, kaffir corn, and wheat) against weevils, and what measures to adopt to clean weevil-infested storerooms. My sheds are of galvanized iron with board floors, and I seem to have these insects all the year round, even if there is no grain in them for the time being. I have tried proprietary preservatives, but to no purpose. I understand the best thing to use is carbon bisulphide, but as this chemical has highly dangerous qualities I would like to make sure if this would bring relief and how it should be employed. Perhaps the empty bags could be treated in the same way before filling in the grain?

Is it true that the eggs of the insect are already in the maize coming fresh from the shelling?

Thanking you in anticipation,—Yours, etc.,

H. BUSSCHE.

P.O. Silverkrans, Transvaal.

[The Assistant Chief of the Division of Entomology (Mr. Claude Fuller) replied:—Upon the assumption that the grain in the bags is not in the least affected with weevil or moth, it can be easily protected by storing in a clean building into which neither moth nor weevil can gain access. Almost any well-built room can be made weevil and moth proof by screening all openings with fine wire gauze, not less than fifteen to the inch. Stout butter-muslin or

cheese-cloth, whilst not so durable, would be equally effective. Store-houses which are known to harbour weevil and moth can only be effectively cleaned by first rendering them air-tight and then fumigating with hydrocyanic acid gas. Full particulars regarding this measure may be obtained upon application to the Division of Entomology. No treatment of the bags can be suggested that would meet the case. It frequently happens that weevil is already present when the maize comes fresh from the shelling; and, in our warmer districts, the infestation starts in the fields when the grain hardens whilst still in the husk.]

FOWL SICKNESS.

To the Editor of the *Agricultural Journal.*

SIR,—It is well-known that throughout the Union thousands of head of poultry are lost all the year round from various obscure diseases. Hundreds of farmers and others have ceased to bother with them and decline to keep fowls owing to the worry and financial loss sustained. It is a great pity that such an easy source of additional income should be so generally shelved, and that enormous sums of money annually are lost to our country by the importation of eggs which could be, and should be, produced in the country. I find that a very simple remedy invariabl yhas succeeded in cases of sickness amongst any poultry, and shall be glad if others who read their *Journal* are enabled to profit by my experience. Three or four grains of permanganate of potash in a teaspoonful of water followed an hour or so later by a little raw linseed oil has cured my fowls time and time again. If you are able to publish this, and perhaps invite correspondence on this subject, it is possible that a fillip may be given to what ought to be a great South African industry.—Yours, etc.,

W. H. GOODWIN.

Mafeking.

UTILIZING STRAW AND CHAFF.

To the Editor of the *Agricultural Journal.*

SIR,—During the Christmas vacation I visited several farms, just after harvesting had been completed. No notice at all was taken of the straw or chaff. I visited farms where there were enormous quantities—accumulations of years.

I then thought it quite a worthless article (I am no farmer) and advised the farmers to put it in the kraals and get it mixed with the manure. However, after I had read with great interest the article on the treatment of mealie ensilage in the December *Journal*, the thought occurred to me that perhaps this "worthless" wheat chaff, when cut finely, could be used dry or mixed with the ensilage as winter fodder for cattle; or, if possible, it could be cut together with the mealie cane and placed in the silo.

If this could be done with good results, many farmers would increase their winter provisions for stock considerably, and at the same time an article that at the present is considered worthless would be used profitably.—Yours, etc.,

J. DE VEER.

P.O. Gezina.

[The above letter was referred to the Principal of the School of Agriculture (Mr. E. J. Macmillan), who observes:—No progressive farmer allows his straw to be burned. If he is in easy reach of a railway and cannot make use of it on the farm, he can bale it and send it to market with profit. Straw and chaff should, however, be used to good purpose on the farm. These dry materials cannot be recommended for mixing with material to be put into the silo, but they are suitable for feeding in conjunction with the ensilage, the straw being first reduced to chaff. Further, any straw not required as feed should be made into manure. If the cattle are not stabled the straw may be thrown in the kraal, where under the effect of trampling by the stock and rain it will greatly increase the manure supply which will become of greater importance from year to year.]

PRESERVING SHEEP AND GOAT SKINS.

To the Editor of the *Agricultural Journal.*

SIR,—Can you or any of your readers advise me the best way of storing goat and sheep skins for the market so as to keep them slightly damp and free from moths, but taht would not on the other hand deteriorate the quality of the skins?

Living a long distance from the railway, with perhaps only once or twice in every twelve months an opportunity to rail produce, I find that my skins become very dry, brittle, and damaged by moths.—Yours, etc.,

J. STEYN.

Red Hill, Douglas.

[The Chief of the Sheep Division (Mr. B. Enslin) replied:—Sheep and goat skins should be painted with arsenic water and then hung up on hooks. This will prevent any deterioration by moths or other causes. It is not desirable to keep the skins damp.]

ORANGE CULTURE.

To the Editor of the *Agricultural Journal.*

SIR,—In the February issue of the *Agricultural Journal* I read that Mr. John Bright, of Buffelspoort, has had much experience in the cultivation of orange trees. I should be glad to have replies to the following questions:—

(1) When should orange trees be planted?
(2) What is the best month to graft in, August or December?
(3) Is it true that oranges or naartjes can be grafted on pomegranate? Somebody has told me so and says that it answers very well.
(4) Is it advisable to plant oranges and naartjes in one row?—Yours, etc.,

ABEL OOSTHUYZEN.

Freyensfontein.

[The Chief of the Horticultural Division (Mr. R. A. Davis) replies:—(1) Oranges may be planted to advantage during the months of December and January in those parts of the country where summer rains occur; they may also be set out soon after the end of July, as may be possible, when danger from frost is over; in fact, any month from then on to December. (2) Grafting oranges should never be practised, but budding may be done as soon as the sap commences to run in August, but it should not be done later than December, because if that should happen the young growth which starts almost immediately will be only in a weak and sappy condition when winter comes on, and will be subject to injury from cold winds or frosts. (3) Neither oranges nor naartjes will grow if grafted on pomegranate; this is purely a fable and your informant was quite wrong. (4) If you are planting out a few oranges and naartjes for your own use, there is no objection to plant these together in one row; but if you intend planting them for commercial purposes, then you had better keep them separate, as the blossoms are likely to cross-fertilize and produce inferior fruit in each case.]

TOMATOES FOR ZOUTPANSBERG DISTRICT.

To the Editor of the *Agricultural Journal.*

SIR,—I shall be glad if you will give me information on the following points:—

In the New Agatha District of the Zoutpansberg, altitude from 3450 to 2000 feet, what is the most suitable variety of tomato to grow for a winter crop, and when should the seed be sown?—Yours, etc.,

SCOTLAND.

[The Manager of the Government Experimental Orchard at Potchefstroom (Mr. W. A. Sturm) replied:—I regret to say that I have no personal experience

of correspondent's district, but I assume that the locality where the tomatoes are to be grown is free from frost, as this is a great essential of success. The variety that I would recommend is the "Beauty," which I would sow in February and transplant when ready. At the same time I would advise to make small trials with the following sorts: "Earliana," "Success," "Best of All," and "Matchless." The main point to aim at is the production of a tomato pleasing to the purchaser and possessing firmness of flesh, thereby ensuring good carrying qualities. "Beauty" answers these requirements; still the other varieties named may prove of some special adaptiveness to the local condition which may make their cultivation desirable. The time of sowing is also subject to alteration, according to local condition, and cannot definitely be given until exhaustive trials are made. In his letter "Scotland" gives the altitude as between 3450 to 2000 feet, a difference of 1450 feet. This in itself will show that there must be a great difference of climatic condition, causing a material difference in growth. Even at the same altitudes, other conditions, such as shelter from winds by hills, forests, etc., influence the climate materially, often to such an extent that on one spot of the farm certain crops can be successfully produced where only a few hundred yards away they are a failure. It will be seen that only general direction can be given; the grower must try by practical experiments to find out the methods best suited to his local condition. Tomatoes which have during summer produced a crop, if cut down now and freshly manured, preferably with nitrate of soda, and the ground dug over with a fork, produce in frost-free localities quite a good crop during winter.]

THE MAHAMBANENDHLWANA.

To the Editor of the *Agricultural Journal.*

SIR,—Can you kindly tell me if the worm called by the Zulus *Mahambanendhlwana* is poisonous to cattle eating it? If necessary, I shall be glad to forward a few specimens for your investigation.—Yours, etc.,

L. R. NIGHTINGALE.

Ginginhlovu, Zululand.

[The Assistant Chief of the Division of Entomology (Mr. Claude Fuller) replies:—That cattle feeding upon veld-inhabiting bagworms or basket-worms (Zulu *Mahambanendhlwana*) die from their poisonous effects, must, I fear, be accepted as part and parcel of the folk-lore of South Africa. It is an aboriginal story, common to many parts of the Union, very generally accepted by European farmers, both Boer and English, which has no foundation in fact nor has circumstantial evidence to support it. Quite apart from the fact that a variety of insects, spiders, birds, and small mammals delight in feeding upon bagworms, the actual feeding of the grass bagworm to an ox resulted in no ill-effects. In the experiment alluded to the creatures were fed to the ox in small numbers at first, because of the prevalent belief that a single one would cause instant death. Later in the experiment the insects were given in greater numbers, so that the animal consumed twenty to thirty without any ill-effects.]

PROTECTION FROM LIGHTNING.

To the Editor of the *Agricultural Journal.*

SIR,—In answer to J. N., Box 776, Johannesburg, *re* the above: If the "rondavel" is being built as a domicile, then the following plan will render it much safer than the answer given by Mr. C. Stewart:—

Supposing the top of roof to be about 20 feet high, get two-30 foot telephone poles of iron and plant on either side of hut about 40 feet apart. Get ordinary lightning conductor rope (galvanized wire ¾-inch thick) and pass it up through both poles, allowing about 6 inches to protrude at top and open into a circular fan with a few for a centre. The bases of poles should be at least 4 feet in the ground, and you can build a rockery round each if you like. The wire rope should then come out from bottom of base and be laid in a slightly descending

trench quite 8 to 10 feet, and at end of wire rope get a plate of the stoutest galvanized plate, say, 18 inches square, soldered after riveting. If you have any old iron work lying about place it on the wire and plate in the trench before covering. Do this to both posts; but before rearing up the posts, and as an additional safeguard, get a further length of galvanized wire rope and fasten to top of each post by a double close hitch, and then bind with smaller galvanized wire and solder over this. This rope would be 130 feet long, i.e. 40 feet between the posts, 35 feet from top of each post to ground, and 10 feet in trench, or you can shorten this by planting an iron post with plate at bottom instead.

By this method you are practically as safe as any means can make such a structure, and the cost will not be more than about £7.

The voltage of lightning flashes is so enormous that it is more than doubtful if any stout fencing wire would not be fused and then your roof catches fire at the least. In my plan you have four earths, whichever post was struck.

I may say I have erected three houses in Natal with flat roofs, covered with sand and broken stones, lying on Heusner's patent wood cement, and put up iron telephone posts as described here.

With the rockery and creepers running up the guy ropes the whole is not unsightly, and you are not living in a fool's paradise.—Yours, etc.,

G. C. WILLIAMS.

Weenen, Natal.

[The above letter was referred to the Chief Meteorologist, who observes:—With an impulsive lightning discharge, i.e. when cloud discharges into cloud thence to earth, there is no time for points to act, and the lightning may strike almost anywhere. It is therefore better for the conductors to be attached to the structure in readiness to carry off the charge. Isolated conductors may even be a source of danger and would only be recommended under exceptional circumstances. Stout fencing wire, well earthed below the subterranean water level, should be efficacious.]

CROSSING RIVERS.

To the Editor of the *Agricultural Journal.*

SIR,—I read with interest the letter of Mr. Blathwayt on the dangers of crossing rivers or spruits. I think, however, that it would be difficult to stretch a rope in such a way that it would meet all accidents. It would have to be strained straight across so that there was no dip in the middle, otherwise a drowning man might be swept under the rope at the sides or over it in the middle of the stream. Prevention is always better than cure, and I think it would be a better plan to prevent travellers from entering a drift when it was unsafe. This might be effected by setting up a beacon pillar at each side of every drift and marking on the pillar a danger point. When the water was up to or over this point travellers would know that the drift was unsafe. The pillars could be set up and the points on them fixed by the constructor of roads or by the district councils.—Yours, etc.,

JOHN A. GRAHAM.

Bethulie.

PLASTER FOR SUN-DRIED BRICKS.

To the Editor of the *Agricultural Journal.*

SIR,—As many inquiries are made as to the best plaster for sun-dried bricks, allow me to advise that cowdung (the fresher the better) and ash, mixed in about equal proportions, will withstand the weather for years, even in exposed positions.—Yours, etc.,

HILDESLEY.

To the Editor of the *Agricultural Journal.*

SIR,—In answer to Mr. C. T. Gordon, of Magoye, *re* the above, I can tell him that there is no really satisfactory "daager" plaster to put on green brick walls, and it is not necessary or required to make a really watertight

surface. To do this one only requires some slurry made of sandy soil in a bucket, and a few old bits of sacking to make a pad of convenient size to hold in one hand, and another bucket to hold plain water. Commencing at the top of wall, dip the pad of sacking in water and quickly rub round and round, roughly washing the wall so to speak; this smooths the surface all but the biggest holes. Then with the left hand take a handful of slurry out of the other bucket, put into centre of wet pad, and rub round and round until the wall is quite smooth. Two boys on a simple plank scaffold on two trestles can do 80 square yards easily in a day. Do not put on more slurry than will just fill all holes in bricks and joints, or it will not be as smooth as it should be. When this is bone-dry, apply with a good whitewash brush hot linseed oil (boiled); let dry a few days and apply a second coat. If the building is an out-building and you do not mind the colour, the second coat should be hot coat-tar.

Any coating of plaster to green bricks other than inside will be sure to chip; water gets in, and it comes off in slabs; it never looks nice, and, if there are white ants about, forms a ladder for them to get to your roof very quickly. I have had buildings made of green bricks treated thus that have stood without a scratch for twenty years.—Yours, etc.,

G. C. WILLIAMS.

Weenen, Natal.

BLUE LIME FOR BUILDING PURPOSES.

To the Editor of the *Agricultural Journal.*

SIR,—Can you please tell me whether blue lime is suitable for use in the construction of dipping tanks. It is said by some that it is as good as cement, and even better, and I shall be pleased to learn your opinion.

Also, please inform me whether this lime is suitable for building houses and dams.—Yours, etc.,

J. P. RHEEDER.

P.O. Nondweni, via Dundee, Natal.

[The Lecturer in Engineering at the Potchefstroom School of Agriculture (Mr. W. S. H. Cleghorn) replies:—Blue hydraulic lime is quite suitable for use in building houses. It can also be employed for building masonry dipping tanks, the joints being raked out to a depth of at least ¾-inch, and well pointed with a mortar consisting of one part portland cement to two parts clean sharp sand. Blue lime concrete is useless for floors, except as a lower layer, which should be covered by at least 2 inches of cement concrete. For low masonry dams up to, say, 15 feet high, a mortar consisting of three parts blue hydraulic lime, one part portland cement, and twelve parts clean sharp sand may be used, the pointing being done with one part portland cement to two parts clean sharp sand.]

The Weather.

By C. STEWART, B.Sc., Chief Meteorologist, Department of Irrigation.

THE mean air temperature over the Union during the month of March was about one degree below the normal, due to lower day temperatures.

Over the west and south of the Cape Province the rainfall was below the normal. In the other parts of that Province, however, and in the Orange Free State and Transvaal, the usual amount of precipitation was reached or slightly exceeded, while in Natal considerable excesses resulted in floods and damage. At Durban this excess was 356 per cent. of the average fall. The rainfall was generally well distributed over the month, except that a dry spell was experienced in certain portions of the Cape during the first week, and in Natal during the latter part of the month.

The rainfall for the year (since 1st January) has been generally deficient, except in Natal and over the Cape northern border and south-eastern districts and parts of the northern Karroo.

JUNE WEATHER CHARACTERISTICS.

June is a dry, sunny month and over no part of the Union, excepting along the western, southern, and south-eastern coasts and in the extreme south-west of the Cape Province, should the rainfall exceed one inch. On the High Veld and Karroo it is not unfrequently, quite rainless.

The rainfall on the Cape Peninsula is, however, still increasing, and should be approximately six inches, whilst over the adjoining south-western districts the monthly maximum of 3·5 inches should be reached. Along the west coast there is a slight decrease; but both there and along the south coast the variation from the May rainfall is inconsiderable. Thunderstorms are now at their minimum.

The mean air temperatures continue to decrease rapidly, the days, excepting on the northern Karroo and in the Transvaal, being the coldest of the year. The Transvaal Low Veld is now the warmest part of the Union with a mean temperature of about 59·5° and Basutoland the coldest with 45·5°. Between these are Natal and the south coast with a normal of 57°, the Cape Peninsula with 56°, the south-eastern districts of the Cape with 55°, the west coast with 54°, Kaffraria with 53°, the north-eastern district and the east-central Karroo with 53·5°, the southern Karroo with 51·5°, the northern borders with 51°, the west-central Karroo with 50°, the Transvaal High Veld with 49·4°, and the Orange Free State, northern Karroo, and Cape north-eastern district with 46°. Sharp night frosts are a characteristic of the High Veld during this month, and killing frosts may be experienced.

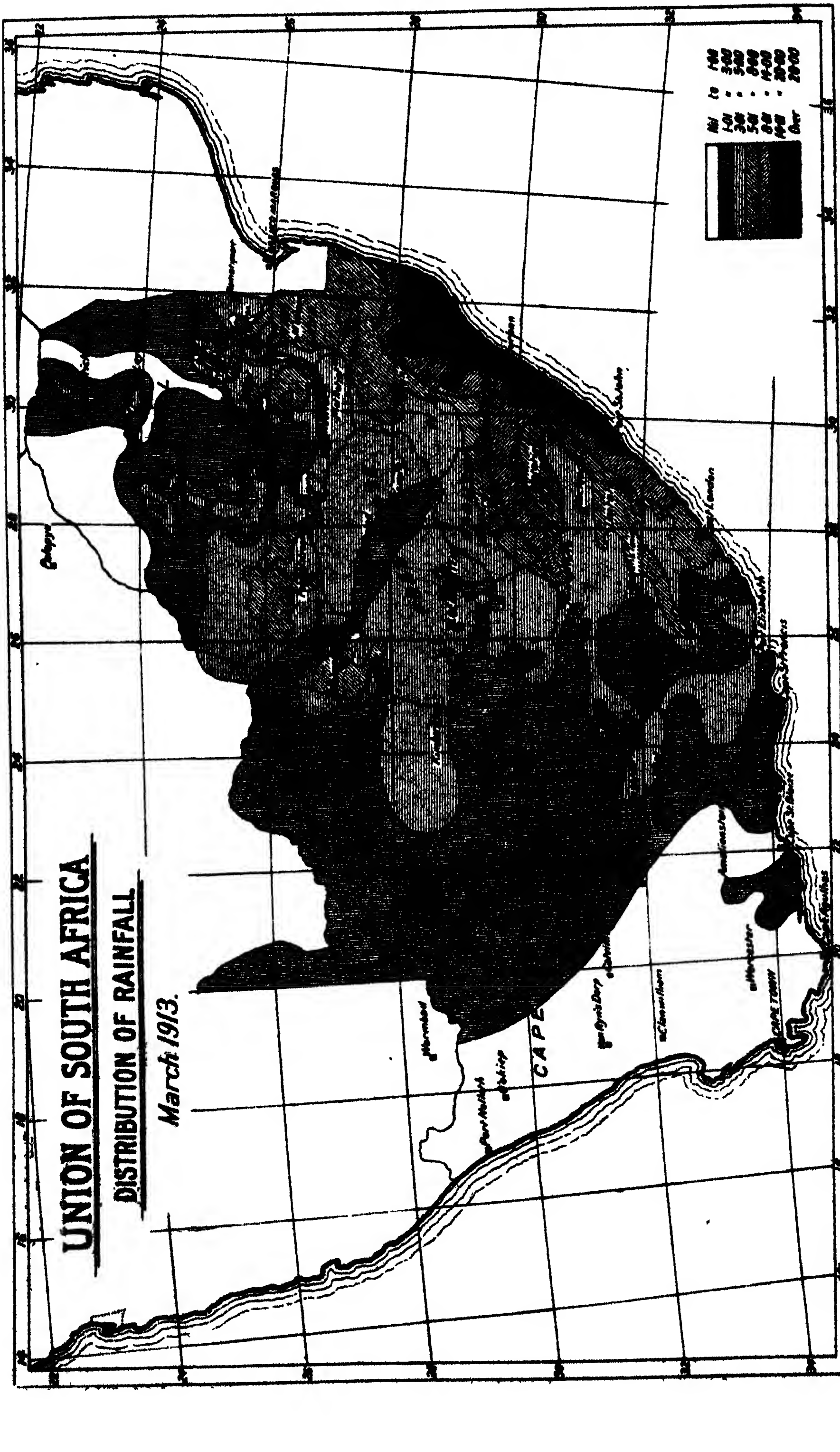
The winds prevailing over the Cape Peninsula are from the north-west and south; over the northern borders of the Cape they are from the south-south-east, and over the Cape south-eastern districts from the north-north-east and north-east.

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN THERMOMETER SCREENS)—MARCH, 1913.

PLACE.	OBSERVER.	Month—March, 1913. Mean Max.	Mean Min.	Monthly Temperature.	Normal Monthly Temperature.	Difference from Normal.	Extremes. Highest.	Date.	Lowest.	Date.
		°	°	°	°	°	°		°	
Transvaal—Louis Trichardt ...	Sergt. J. C. N. Clark	79·4	59·5	69·4	68·8	+0·6	91·0	6th	52·0	19th.
Pietersburg	W. Frankleyne ...	79·5	56·6	68·0	67·0	+1·0	88·0	6th	51·0	18th.
Zeerust	H. Dietrich... ...	84·0	58·0	71·0	69·7	+1·3	94·0	6th	50·0	3rd.
Pretoria (Arcadia) ...	J. Lyall Soutter ...	79·6	56·0	67·8	67·8	—	89·1	6th	47·4	3rd.
Belfast	G. J. Imrie... ...	69·0	49·3	59·1	59·3	—0·2	78·0	6th	38·0	3rd.
Mbabane (Swaziland).	A. C. Hulett ...	71·7	55·9	63·8	64·4	—0·6	82·0	5th, 6th, & [21st	49·0	27th.
Johannesburg (Obser.)	Staff	71·7	52·6	62·1	62·3	—0·2	80·5	6th	42·8	2nd.
Potchefstroom ...	J. R. Stenning ...	83·0	56·1	69·5	66·8	+2·7	92·6	6th	49·0	2nd.
Christiana	S. W. Davis ...	86·5	58·9	72·7	69·6	+3·1	94·0	8th	54·0	4th, 5th, 9th, 17th, & 18th
Komatipoort	H. J. Evans ...	87·8	66·9	77·3	77·0	+0·3	99·0	5th & 25th	57·0	19th.
Free State—Bloemfontein ...	H. Arndt	78·3	56·1	67·2	66·8	+0·4	86·8	7th	51·7	14th.
Lindley	J. Oates	76·6	53·3	64·9	65·3	—0·4	99·0	20th	44·0	23rd.
Harrismith	J. B. Patterson ...	68·4	48·4	58·6	61·0	—2·4	77·0	11th	38·0	4th.
Cape—Hanover	W. J. Myburg ...	79·2	57·6	68·4	64·0	+4·4	90·0	10th	43·0	31st.
Aliwal North	A. Brown	80·3	52·3	66·3	66·1	+0·2	89·0	10th	46·0	16th & 20th.
Kokstad	H. D. Coyte ...	70·5	50·5	60·5	63·6	—3·1	79·9	31st	41·0	2nd.
Queenstown	H. Holley	76·7	55·0	65·8	68·1	—2·3	91·0	11th	41·0	16th.
Bedford	T. C. Hall	75·8	55·0	65·4	66·8	—1·4	93·0	—	48·0	—
East London	M. G. Grogan ...	73·0	62·8	67·9	68·7	—0·8	82·0	24th	59·0	14th, 16th, 18th, & 19th
Amalienstein	Rev. Paul Prozesky	84·5	57·2	70·8	73·2	—2·4	97·0	2nd	47·0	16th.
Capetown (Observatory)	Staff	80·9	60·5	70·7	68·0	+2·7	95·7	3rd	54·0	22nd.
Wynberg	Sister Mary Imelda	81·0	57·9	64·4	67·2	—2·8	95·0	3rd	54·0	15th.
Mossel Bay	G. Draper	71·1	57·8	64·4	68·6	—4·2	79·0	2nd	52·0	19th.
Port Elizabeth ...	P. E. Morgan ...	73·1	60·9	67·0	69·0	—2·0	80·0	5th	55·0	14th.
Natal—Durban	A. J. O. Andreasen	74·2	67·0	70·6	76·0	—5·4	81·0	18th	63·0	4th, 14th, & [15th.
Maritzburg	Natal Asylum ...	76·6	57·6	67·1	71·4	—4·3	87·0	12th, 18th, & [24th	53·0	28th.
Dundee	T. Kenny	76·7	56·0	66·3	68·6	—2·3	89·0	21st	50·0	1st.
Hlabisa	E. D. Lightening ...	78·1	51·9	65·0	—	—	86·0	13th	60·0	On 14 days.

RAINFALL RETURN FOR MARCH, 1913.

PLACE.	OBSERVER.	MONTH. March, 1913.	MONTH. Normal.	MONTH. Difference from Normal.	YEAR. From 1st Jan., 1913.	YEAR. Normal.	YEAR. Difference from Normal.
		ins.	ins.	ins.	ins.	ins.	ins.
Transvaal—							
Komatipoort ...	H. J. Evans ...	4·30	4·57	—0·27	9·73	13·58	—3·85
Christiana ...	S. W. Davis ...	3·56	3·18	+0·38	11·35	10·23	+1·12
Belfast	G. J. Imrie ...	4·02	3·95	+0·07	13·71	13·81	—0·10
Pilgrims Rest ...	E. Elphinstone ...	3·29	6·48	—3·19	16·51	22·12	5·61
Zeerust	H. Dietrich ...	4·58	3·60	+0·98	11·57	12·83	—1·06
Middelburg ...	Dr. H. A. Spencer	2·51	3·43	—0·92	9·46	12·86	—3·40
Potchefstroom ...	H. R. M. Bosch ...	5·23	3·14	+1·09	9·94	11·91	—1·97
Pretoria	J. Lyall Soutter...	3·17	3·87	—0·70	15·29	14·32	+0·97
Standerton ...	A. von Backstrom	3·79	3·57	+0·22	13·07	14·47	—1·47
Pietpotgietersrust	S.A. Police ...	2·56	3·09	—0·53	11·57	12·21	—0·64
Johannesburg ...	Observatory Staff	4·47	4·06	+0·41	10·21	14·43	—4·22
Louis Trichardt ...	Sgt. J. C. M. Clark	1·30	3·24	—1·94	13·88	14·76	0·88
Pietersburg ...	W. Frankleyne ...	1·44	2·47	—1·03	10·55	9·79	+0·76
Piet Retief ...	W. A. Humphries	5·94	4·34	+1·60	17·79	16·28	+1·51
Swaziland—							
Mbabaan... ...	Swaziland Police	5·78	6·50	—0·72	23·32	23·33	—0·01
Natal—							
Maritzburg ...	Govt. Asylum ...	9·62	4·65	+4·97	28·79	13·55	+15·24
Dundee	The Gaoler ...	7·27	4·14	+3·13	17·45	15·42	+2·03
Hlabisa	E. D. Lightening	16·41	5·07	+11·34	30·21	15·72	+14·49
Port Shepstone ...	A. B. Cox ...	17·40	8·04	+9·36	28·57	17·79	+10·78
Bulwer	A. Brown ...	10·63	—	—	28·89	—	—
Durban	A. J. O. Andreason	20·77	4·55	+16·22	38·37	13·66	+24·71
Cape—							
Mafeking ...	A. Webster ...	4·37	3·40	+0·97	11·13	10·01	+1·12
Vryburg	J. T. Morrison ...	4·38	3·28	+1·10	9·97	16·16	—6·19
Griquatown ...	E. Hanstein ..	3·90	2·70	+1·20	8·74	6·99	+1·75
Prieska	M. Drummer ...	2·18	2·21	—0·03	5·79	4·85	+0·94
Fraserburg ...	P. J. Booysen ...	0·77	1·15	—0·38	4·83	2·84	+1·99
Clanwilliam ...	W. J. Downes ...	0·00	0·26	—0·26	0·00	0·81	—0·81
Calvinia	W. Harvey ...	0·05	0·68	—0·63	0·40	1·48	—1·08
Piquetberg ...	A. H. Morris ...	0·00	0·43	—0·43	0·58	1·52	—0·94
Britstown ...	P. A. Myburg ...	2·56	2·52	+0·04	6·92	4·93	+1·99
Carnarvon ...	J. Sullivan ...	1·52	1·43	+0·09	4·02	4·14	—0·12
Hanover	W. J. Myburg ...	1·90	2·49	—0·59	5·91	6·63	—0·72
Aliwal North ...	A. Brown ...	3·60	4·03	—0·43	8·90	11·75	—2·85
Queenstown ...	H. Holley ...	3·51	3·56	—0·05	12·82	11·50	+1·32
Kokstad ...	H. D. Coyte ...	5·22	3·48	+1·74	17·37	11·77	+5·60
Port St. Johns ...	F. J. Lloyd ...	19·97	5·05	+14·92	37·65	15·30	+22·35
Worcester ...	W. B. Sutton ...	0·00	0·47	—0·47	0·30	1·21	—0·91
Capetown Observ.	The Staff... ...	0·11	1·12	—1·01	1·33	2·55	—1·22
Wynberg ...	Sister Mary Imelda	0·07	1·34	—1·27	2·06	3·04	—0·98
Amalienstein ...	Rev. Carl Prozesky	0·85	1·37	0·52	2·54	3·74	—1·20
Swellendam ...	H. Montgomery...	0·94	2·96	—2·02	2·98	8·10	—5·12
Mossel Bay ...	G. Draper ...	0·48	1·54	—1·06	2·32	3·99	—1·67
Beaufort West ...	W. T. Golledge ...	1·95	1·33	+0·62	5·28	3·61	+1·67
Uniondale ...	E. J. Stewart ...	1·79	1·51	+0·28	4·38	3·35	+1·03
Knysna	Chas. Wilding ...	1·16	2·32	—1·16	3·86	6·54	—2·68
Graaff-Reinet ...	J. A. Simpson ...	3·33	2·78	+0·55	8·76	6·47	+2·29
Steytlerville ...	P. R. de Wet ...	3·72	1·46	+2·26	9·81	3·52	+6·29
Port Elizabeth ...	P. E. Morgan ...	3·82	1·51	+2·31	6·48	3·57	+2·91
Bedford ...	T. C. Hall ...	5·47	3·99	+1·48	12·98	10·77	+2·21
East London ...	Capt. M. C. Grogan	6·72	2·65	+4·07	15·07	7·20	+7·87
Hopetown ...	C. B. Scott ...	3·47	2·92	+0·55	5·84	6·81	—0·97
Umtata	R. C. W. Hampson	5·21	3·40	+1·81	13·36	10·05	+3·31
Philipstown ...	P.W. van Wyln-Kal	3·88	2·62	+1·26	7·16	6·64	+0·52
Orange Free State							
Bloemfontein ...	H. Arndt... ...	2·03	3·76	—1·73	8·47	11·28	—2·81
Harrismith ...	J. B. Patterson ...	3·91	3·43	+0·48	11·31	12·75	—1·44
Lindley	Jno. Oates ...	3·83	3·46	+0·37	7·85	12·37	—3·52


UNION OF SOUTH AFRICA
DISTRIBUTION OF RAINFALL
March 1913.

South African Produce Markets.

CAPETOWN.

The Produce Department of the firm of R. Müller, Capetown, reports under date of the 29th April, 1913, as follows :—

Ostrich Feathers.—Sales were held in London in the early part of this month and amounted to £367,000 sterling. The attendance was good and competition, both from the Continent and America, was satisfactory. However, best whites and feminas receded 15 %, primes kept steady, narrows and thirds advanced 15 %, dark feminas and byocks rose up to 10 %, spadonas advanced 15 to 20 %, boos went 10 to 15 % higher, long and medium blacks, also long and medium drabs, 10 % higher. All other kinds kept steady in price, with the exception of best floss, which were sold 10 % cheaper than at the previous sales.

Moderate quantities changed hands in Capetown during the month of April, but all the feathers offered realized highly satisfactory prices, in fact, more than could be anticipated.

The Capetown market shows a very fair demand and a sound competition, which, of course, is all in favour of sellers. Farmers and dealers will therefore do well to consign their goods to Capetown with the least possible delay.

Prices now ruling here are as follows :—

	£	s.	d.		£	s.	d.
Primes...........	18	0	0	to	28	10	0
First	11	0	0	„	16	0	0
Second whites	8	0	0	„	10	10	0
Third whites	5	0	0	„	7	0	0
Inferior and stalky whites	2	10	0	„	3	10	0
Byocks and fancy	3	0	0	„	10	0	0
Superior feminas..	12	10	0	„	16	10	0
First feminas	8	0	0	„	11	10	0
Second feminas ...	5	10	0	„	8	10	0
Third feminas	3	0	0	„	5	0	0
Greys	3	10	0	„	9	0	0
White boos	2	0	0	„	4	10	0
Light boos	1	5	0	„	2	10	0
Dark boos........	0	5	0	„	0	15	0
Inferior boos and tipless	0	5	0	„	1	5	0

	£	s.	d.		£	s.	d.
Long blacks	3	0	0	to	6	10	0
Medium blacks	1	10	0	„	2	10	0
Short blacks	0	5	0	„	1	0	0
Long floss blacks...	1	10	0	„	2	5	0
Medium floss blacks	0	17	6	„	1	10	0
Short floss blacks...	0	5	0	„	0	10	0
Long drabs........	2	10	0	„	3	15	0
Medium drabs	0	10	0	„	2	0	0
Short drabs........	0	2	6	„	0	7	6
Long floss drabs....	1	15	0	„	2	5	0
Medium floss drabs	0	17	6	„	1	10	0
Short floss drabs ...	0	5	0	„	0	10	0
Inferior long blacks and drabs	0	15	0	„	2	0	0
Common blacks and drabs	0	2	0	„	0	5	0
Spadonas	1	10	0	„	5	10	0

Wool.—On the 22nd instant the London wool sales opened. The attendance was large and wools were keenly competed for. Whilst Australian and New Zealand merinos and cross-breds remained unchanged, prices for Cape wools improved. There were many buyers, especially for Cape wools, which rose up to 5 %.

On account of the prevailing season, small wool sales only have taken place at Capetown. Exporters are anxious to purchase, especially light-conditioned wool.

The following are to-day's Capetown quotations :—

	d.		d.
Calvinia, long..................	6¼	to	7
Calvinia, medium	6	„	6½
Karroo and Roggeveld...........	6	„	9½
Short burry wools, heavy........	4	„	4¾
Short burry wools, light.........	4¾	„	5½
C. and C., best grease...........	4¾	to	6
C. and C., medium	3½	„	4¾
C. and C., inferior	1	„	3
Malmesbury...................	5¾	„	6¾

Skins.—On the 3rd instant the London sales opened, at which 227,000 goatskins were offered for sale, of which 110,000 were sold immediately. The attendance was moderate. Owing to a good demand, heavies and medium realized former prices. The demand was not so great for light and extra light, which partly receded by ½d. Kids were sold at 1d. to 1½d. decline; and a decline of ¼d. to ¾d. was experienced for sundried. Bastards went ½d. cheaper. Dry damaged remained unchanged.

The Capetown market has the great advantage of keeping steady, and the undermentioned prices show that sales can be effected here altogether in favour of sellers.

Hereunder to-day's Capetown prices:—

Goatskins, light	13d. per lb.	Longwools, Karroo	6¾d. per lb.
Goatskins, heavy	11d. per lb.	Shortwools	5¼d. per lb.
Sundried and kids	8d. per lb.	Pelts and damaged	4½d. per lb.
Angoras	7d. per lb.	Capes, large	3s. 1d. each.
Angoras, bastard	10d. per lb.	Capes, medium	2s. 4d. each.
Angoras, shorn	5½d. per lb.	Capes, cut	1s. 6d. each.
Caledon	7d. per lb.	Capes, damaged and lambs	7d. each.

Hides.—Fortunately, I am able to report that the Capetown market still maintains the previous high prices, namely, 10d. per lb. for sound hides and 7d. to 8d. for damaged hides.

EAST LONDON.

The Produce Department of Messrs. Malcomess & Co., Ltd., write as follows under date 28th April, 1913:—

Wool.—The month under review commenced with European cables advising the probability of a slight easing off in prices consequent upon money stringency and slight signs of slackening trade, whilst it was argued that the shrinkage in production of raw wool would prevent prices coming down very far, with a very good chance of a rise again later on in the year.

The Antwerp sales then opened on the 17th and the result came over the wires as "on a par with last Antwerp rates." As usual, London followed Antwerp, and the third series of London Colonial wool sales opened on Tuesday, the 22nd instant, with an offering of 187,000 bales, of which about 12,000 bales were Capes.

Rates rule as follows:—

Long super combing grease	Unchanged.
Long Australian merinos	Unchanged.
Long heavy combing grease	Mostly ½d. lower.
Snow-whites	Slightly lower.

It is very difficult to forecast the tendency of the market accurately during the next few months, more especially in view of the political situation in Europe, but a good feature of the wool market is the probable placing of extensive military cloth orders and the possibility of the reduced tariff on wool in America—if it goes through acting as a stimulus to American buyers in European operations.

In Bradford the tops quotation, which end of last month stood at 29d., must now be quoted at 28¾d.

On the Continent business progresses with a fair turnover at more or less unchanged rates.

In the local market the month opened very firm indeed, with a slight falling off during the second week. All dry wools command keen competition, while parcels that are damp are left on one side.

The month's transactions are as follows:—

	Bales.	Bales.		
Week ending 2nd,	1,900 offered,	1,000 sold.	Sales for week,	1,500 bales
„ „ 9th,	1,900 „	1,000 „	„ „	2,000 „
„ „ 16th,	3,000 „	1,800 „	„ „	2,500 „
„ „ 22nd,	3,500 „	1,300 „	„ „	2,000 „
	10,300 „	5,100 „	Total ...	8,500 „

We quote as follows:—

	d.		d.
Transkeis, best clean dry light parcels	8	to	9¼
Transkeis, average parcels	7¼	„	8
N. S. Basutos, good to average	6½	„	7¼
Super short Kaffrarian farmers', purely nominal	8	„	10¾
Super long Kaffrarian farmers', purely nominal	8	„	11½
Super short well-conditioned grassveld	6	„	9¼
Super long well-conditioned grassveld	6½	to	9½
Short faulty grease	4½	„	6½
Long „ „	5¼	„	7½
C. and C. grease (good average)	5½	„	6¼
„ „ (very kempy to inferior)	3	„	5

Leaving stocks in town about 6500 to 7000 bales.

Mohair.—The position under this heading is complicated by the strike among the mohair sorters, and after some activity, the market is a trifle quiter for the moment.

We quote:—

	d.	d.		d.	d.
Good to best Basuto hair, sorted	11		Super short summer hair	11	to 12
Average Basuto hair	9	to 11	Super long summer hair	12	„ 12½
Sortings according to quality and length	5½	„ 7½	Super summer kids	16	„ 18
Coloured hair, up to	6½		Average summer kids	14	„ 16

Sundry Produce.—The sundry produce markets are weak, though the drop in the quotations for sheepskins is chiefly due to the lesser proportion of good length skins in the parcels now coming to hand.

We quote:—

Sundried hides	11½d.	Sheepskins—1st quality parcels	6½d.
Dry-salted hides	10½d.	„ C. and C. skins	5d. to 5½d.
Goatskins	12d.	„ Do. including Capes	5¾d.
Bastards	10d.	„ Pelts	4½d.
Angora-skins	8d. to 8½d.	„ Transkeis	4¾d.
Damaged	5d. each.	Horns, according to quality and size	2d. to 3d.

DURBAN.

Messrs. Reid & Acutt's Wool Mart, Ltd., Esplanade, Durban, report as follows under date 28th April, 1913:—

Wool.—Arrivals locally have not been heavy recently, the quantity of summer wools handled this season being under the average. This, without doubt, is largely due to the fact that the severe drought which existed in most parts of the country last spring has caused a marked diminution in the number of lambs now being shorn.

Moreover, the custom of shearing a six months' clip is going out of fashion, farmers preferring to shear one long clip of twelve months' growth.

On our sales during the past month the market has continued exceedingly firm and active, with a strong demand for all light-conditioned lambs and short wools, and all such classes have been changing hands at excellent rates, some splendid prices having been realized.

As we stated in our last report, however, heavy-conditioned parcels and all very short "snuffy" lots have not continued in favour, and values for these descriptions have tended to recede.

Stocks on hand in town are very small and consist almost solely of heavy-conditioned long wools, which have been held over for some time in consequence of up-country sellers' ideas still being much too high.

The third series of London sales opened on the 22nd instant, when we received the following cablegrams from our friends there, viz.:—

"Wool sales have opened compared with the closing rates of last series:—

Long grease combing, all classes	2½ % higher.
Grease clothing, light	2½ % higher.
„ heavy	Unchanged."

And:—

"The third series of London sales have opened with the usual large contingent of buyers. Competition was active and well sustained throughout the sales. Compared with the close of the previous series we quote as follows:—

Good long combing grease	Par to ½d. higher.
Short clothing grease	Unchanged.
Short combing grease	Unchanged.

There was a fair show of South African wools."

Coarse and Coloured Wool.—This still continues in keen demand at fully maintained rates.

Mohair.—This market is also brisk with a keen inquiry for all lots offered, and prices recently have advanced considerably.

PORT ELIZABETH.

Messrs. John Daverin & Co. report as follows under date 3rd May, 1913:—

Ostrich Feathers.—The market on Monday opened with a weaker tone, and, though it recovered a little on Tuesday, it became easier again on Wednesday, and closed with a marked lower tendency on wings generally. We do not fear any serious set back—except possibly on common wings, which are still comparatively dear but we think it might be as well to be prepared for a slightly lower level of prices for wings than the rates which have been paid recently. Dark goods in general are fairly steady, and the active demand for spadonas continues.

The prohibition of the importation of wild bird's feathers into America may have the effect of improving the ostrich feather trade in the United States.

The value of feathers sold on our market this week amounted to £35,763. 11s. 10d., and weighed 10,946 lb. 5¼ oz.

We quote the following as current prices for:—

	£	s.	d.		£	s.	d.
Primes:							
Extra super	22	10	0	to	30	0	0
Good	17	10	0	,,	20	0	0
Whites:							
Good to super	10	0	0	,,	15	0	0
Good average	8	0	0	,,	9	0	0
Average	6	10	0	,,	7	10	0
Common and narrow	3	15	0	,,	5	5	0
Good broken	7	10	0	,,	10	0	0
Thirds	2	5	0	,,	4	10	0
Fancies:							
Good	6	10	0	,,	8	10	0
Ordinary	4	0	0	,,	5	15	0
Feminas:							
Super	10	0	0	,,	14	0	0
Good average	7	0	0	,,	8	10	0
Average	4	15	0	,,	6	0	0
Common and narrow	2	15	0	,,	4	0	0
Good broken	5	10	0	,,	8	0	0
Thirds	2	0	0	,,	2	15	0
Greys:							
Good	5	0	0	,,	7	10	0
Ordinary	3	0	0	,,	4	10	0
Tails:							
Male, good, big, bold	2	10	0	,,	3	5	0
Male, good average	1	15	0	,,	2	5	0
Short and narrow	0	17	6	,,	1	10	0
Female, light, good, big, bold	2	0	0	,,	3	0	0
Female, light, good average	1	10	0	,,	1	15	0
Female, light, short and narrow	0	10	0	,,	1	0	0
Tails—(contd.):							
Female, dark, good, big, bold	1	0	0	to	1	15	0
Female, dark, good average	0	15	0	,,	0	17	6
Female, dark, short and narrow	0	7	6	,,	0	12	6
Blacks:							
Long (special)	5	0	0	,,	7	0	0
Long, good	3	10	0	,,	4	10	0
Long, fair	2	0	0	,,	3	0	0
Long, drabby	1	0	0	,,	2	5	0
Medium	1	10	0	,,	2	10	0
Short	0	10	0	,,	0	15	0
Wiry	0	3	0	,,	0	6	0
Floss, long	1	2	6	,,	1	12	0
Floss, short	0	9	0	,,	0	14	0
Drabs:							
Long, special	3	0	0	,,	4	5	0
Long, good	2	0	0	,,	2	10	0
Long, fair	1	5	0	,,	1	15	0
Medium	0	17	6	,,	1	10	0
Short	0	5	0	,,	0	12	6
Wiry	0	2	0	,,	0	5	0
Floss, long	1	2	6	,,	1	12	0
Floss, short	0	9	0	,,	0	14	0
Spadonas:							
Light (special)	4	0	0	,,	6	0	0
Light, fair to good	2	0	0	,,	3	10	0
Light, narrow	0	17	6	,,	1	15	0
Dark	1	0	0	,,	2	10	0
Chicks	0	1	6	,,	0	5	0

The following may be quoted as the approximate current values of unsorted parcels per line:—

	Whites.							*Feminas.*						
	£	s.	d.		£	s.	d.	£	s.	d.		£	s.	d.
Superior pluckings	8	10	0	to	10	0	0	6	10	0	to	8	0	0
Good average lots	7	0	0	,,	8	0	0	5	0	0	,,	6	0	0
Poor average lots	5	5	0	,,	6	10	0	3	10	0	,,	4	5	0
Common lots, stalky, narrow, and discoloured	3	15	0	,,	4	15	0	2	10	0	,,	3	5	0

	Tails.					*Blacks.*					*Drabs.*					*Spadonas.*				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
Good	30	0	to	40	0	20	0	to	40	0	17	6	to	30	0	50	0	to	80	0
Average	17	6	,,	25	0	12	6	,,	15	0	10	0	,,	12	6	35	0	,,	50	0
Poor	10	0	,,	15	0	8	0	,,	10	0	6	0	,,	7	6	20	0	,,	30	0

It will be understood that for special lots these quotations may be exceeded.

Wool.—The market has been fairly active during the week, and a fair amount of business has been done both out of hand and on the catalogue sales held on Wednesday.

Prices for well-conditioned wools show some improvement, and the demand to-day is more active than it has been during the week, which has enabled us to secure prices in advance of those hitherto obtainable. Even very wasty greasy wools are receiving more attention, and for lots not over wasty there is a decided improvement on the prices hitherto offered.

At the catalogue sales on Wednesday 1463 bales were offered, of which 600 bales were sold.

The demand was active for good light wools, especially short wools.

We quote the following as current prices :—

	d.		d.
Snow-white, extra superior	22	to	23
" superior	21	"	22
" good to superior	20	"	21
" inferior faulty	17	"	18½
Grease, super choice clips	10¾	"	11½
Grease, super long, well-conditioned, grassveld grown (special clips)	10½	"	11½
Grease, super long, grassveld grown	9	"	9½
Grease, super long, Karroo grown (special clips)	9	"	9½
Grease, super long, Karroo grown	7½	"	8¼
Grease, super long, mixed veld	7¼	"	7½
Grease, light, faultless, medium, grassveld grown	8	"	8½
Grease, light, faultless, medium, Karroo grown	7½	"	8¼
Grease, light, faultless, short, Karroo grown	6½	"	7½

	d.		d.
Grease, short, very wasty	5	to	5¾
Cross-bred grease	6¾	"	9
Cross-bred scoured	14	"	16
Grease, coarse and coloured	6	"	6¾
Scoured, coarse and coloured	9	"	14
Basuto grease, short	6½	"	7
O.F.S. grassveld grease, long and well-conditioned (special clips)	8¼	"	8½
O.F.S. grassveld grease, long and well-conditioned	6½	"	7½
O.F.S. grassveld grease, medium grown, light, with little fault	6¼	"	7
O.F.S. grassveld grease, short, faulty, and wasty	5½	"	6½
O.F.S. Karroo grown, long and well-conditioned	6¾	"	7½
O.F.S. medium grown, light, with little fault	6	"	7
O.F.S. short, faulty, and wasty	5	"	5½

Mohair.—The new season's clip is still coming forward rather slowly. There is but a limited demand for firsts; sales have been made at 1s. and super kids at 21d. to 22d.

Our London agents cabled us on Tuesday as follows :—

> "To-day prices for good summer firsts 13½d., strong firsts 13d. Feel confident market will develop satisfactorily on this basis, provided values are not forced unduly in Colony."

From this it will be seen that the prices being paid in London for firsts are about on a parity with those that are being paid here.

Stocks of firsts in London are not over heavy, and as the clip begins to arrive here, and a more active demand sets in, we are hopeful that better prices will be paid than are now obtainable.

The following are current values of—

	d.		d.
Super summer kids	21	to	22
Good ordinary kids	18	"	20
Mixed kids	16	"	17
Good ordinary firsts	12¼	"	12½
Mixed firsts	11½	"	12
Superfine long blue O.F.S. hair	12½	"	13½
Mixed O.F.S. mohair (average)	10½	"	11½
Mixed O.F.S. mohair, very mixed	9½	"	10

	d.		d.
Seconds and grey	8½	to	9
Thirds	6	"	7
Winter kids, special clips (nominal)	14½	"	16
Winter kids, good ordinary	13½	"	14
Winter mohair	9¾	"	10¾
Basuto mohair	11½	"	12½
Basuto mohair, grey	8	"	9

Skins.—The following are the prices we obtained for the several descriptions this week :—Sheepskins, 6¼d. per lb.; damaged, 5¼d. per lb. Pelts, 4½d. per lb.; damaged, 3¼d. per lb. Hair Capes, 2s. 9d. each ; sundried, 1s. 9d. each ; cut, 1s. each ; damaged, 7d. each. Coarse wools, 6¼d. per lb.; damaged, 3½d. per lb. Goat, 13d. per lb. ; heavy, 10d. per lb. ; sundried, 10½d. per lb. ; damaged, 6d. per lb. Bastards, 11d. per lb. ; damaged, 4½d. per lb. Angora, 8¼d. per lb. ; sundried and heavy, 7¼d. per lb. ; shorn, 6d. per lb. ; damaged, 3¾d. per lb. Johannesburg sheep, 5d. ; damaged sheep, 2½d. Pelts, 2¼d. Goat, 10d. ; damaged, 5d. Angora, 6½d. ; damaged, 2d. per lb.

Hides.—Sundried, 11½d. ; damaged, 10½d. ; salted, 10½d. ; damaged, 9½d. per lb.

Horns.—3½d. each all round.

Importation of Live Stock.

Return showing particulars of certain Pure-Bred Live Stock recently imported into the Union of South Africa.

Stud-Book No. or Name.	Breed and Stud-Book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
Horses:				
No. 21	Shetland.—Shetland Pony Stud-book	Stallion	Shetland	P. B. Davis, Pritchard Street, Johannesburg.
"Michelin," No. 15953	Clydesdale.—Stud-book, vol. 33	„	England	Wm. Nicol, Napier, Kimberley, C.P.
"Bangdale," No. 16451	Clydesdale.—Stud-book, vol. 34	„	„	„ „
"Spanish Point," No. 16	Thoro'bred.—English Stud-book, vol. 21, page 572	„	„	H. F. Seale.
"Rockburn," No. 2818	Thoro'bred.—English Stud-book, vol. 21, page 15	„	„	R. F. Hall, Port Elizabeth.
No. 17053	Clydesdale.— No particulars	„	U.K.	Wm. McFie, sen., Highlands Farm, Natal.
Unnamed	Thoro'bred.—English Stud-book, vol. 21, page 451	Mare	England	H. C. Quickelbury, Kingwilliamstown.
"Masudah" ...	Thoro'bred.- English Stud-book, vol. 22	„	U.S.A.	George Naylor, P.O. Box 2589, Johannesburg.
"Allassy"	„ „	„	„	„ „
Cattle:				
"Proud Czar" ...	No particulars ...	Bull	England	C. W. Dister, Bowden Hall, P.O. Middelburg, C.P.
No particulars ...	South Devon.—Herd-book, vol. 13, page 4	„	U.K.	Otto Norton, Riet Vlei, Natal.
10 Bulls	„ „	Bulls	„	G. W. Nourse, Zandspruit, Transvaal.
No particulars ...	Lincolnshire Red Shorthorn.—Stud-book, vol. 12	Bull	„	Dr. Rouillard, Durban.
6 Cows	„ „	Cows	„	„ „
No particulars ...	Coates Shorthorn.—Shorthorn Book, vol. 58	Bull	„	Dr. J. M. Ormond, Ingogo, Natal.
„ „ ...	„ „	„	„	J. Fly, Elandskop, Natal.
„ „ ...	„ „	„	„	Dickinson Bros., Nels Rust, Natal.
„ „ ...	Coates Shorthorn.—Shorthorn Book, vol. 59	„	„	O. Hosking, Maritzburg, Natal.
„ „ ...	Ayrshire.—Herd-book, vol. 34	„	„	Wm. McFie, Maritzburg, Natal.
12 Heifers	Ayrshire.—Herd-book, vols. 35 and 36	Heifers	„	„ „

Stud-Book No. or Name.	Breed and Stud-Book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
CATTLE (*continued*):				
No. 30830	Aberdeen.—No particulars	Bull	U.K.	Colin Stoney, Buadaford, Fort Beaufort.
7 Bulls	Hereford. — English Hereford Herdbook, vol. 44	Bulls	"	C. Woods, Standerton.
3 Heifers	Coates Shorthorn.—Herdbook, vol. 59	Heifers	"	C. Droone, Rosetta, Natal.
No particulars ...	Coates Shorthorn. Herdbook, vol. 55, page 794	Cow	"	" "
" " ...	Coates Shorthorn.—Herdbook, vol. 57, page 973	"	"	" "
" " ...	Coates Shorthorn. Herdbook, vol. 58, page 891	"	"	" "
4 Bulls	Coates Shorthorn.—Herdbook, vol. 59	Bulls	"	" "
SHEEP:				
No particulars ...	Wanganella.—No particulars	Ram	Australia	J. S. Minnaar, Graaff-Reinet, C.P.
20 Rams	" "	Rams	"	Mosenthal & Co., East London.
200 Ewes	" "	Ewes	"	" "
80 Rams	No particulars ...	Rams	"	C. H. Pope.
10 Ewes	" " ...	Ewes	"	"
2 Lambs	" " ...	Lambs	"	"
49 Ewes	" " ...	Ewes	"	"
14 Lambs	" " ...	Lambs	"	"
SWINE:				
No. 39851	Large Black.—Society's Herdbook, vol. 14	Boar	U.K.	Findlay Best, Clocolan, O.F.S.
" 10916	" "	Sow	"	" "
" 11398	" "	"	"	" "
" 11400	" "	"	"	" "
" 11402	" "	"	"	" "
" 11404	" "	"	"	" "

Current Market Rates of Agricultural Produce and Stock.

The following TABLE OF CURRENT MARKET RATES OF AGRICULTURAL PRODUCE AND LIVE STOCK on Saturday, 3rd May, 1913, ruling at the several Centres named, is published for general information.

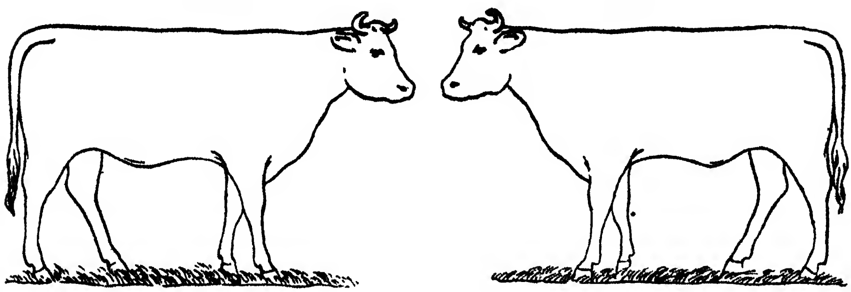
Centre.	A. Wheat per 100 lb.	B. Wheat Flour per 100 lb.	C. Boer Meal per 100 lb.	D. Mealies per 100 lb.	E. Mealie Meal per 100 lb.	F. Barley per 100 lb.	G. Oats per 100 lb.	H. Oat-hay per 100 lb.	J. Lucerne Hay per 100 lb.	K. Potatoes per 100 lb.	L. Tobacco (Boer Roll) per lb.	M. Beef per lb.	N. Mutton per lb.	O. Fresh Butter per lb.	P. Eggs per dozen.	Q. Cattle (Slaughter).	R. Sheep (Slaughter).	S. Pigs.
Cape Province:	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	s. d.	£ s. d.
Aliwal North ...	11 6	23 0	30 0	20 0	22 0	15 0	16 0	7 0	6 0	25 0	1 0	0 8	0 6	1 0	1 6	12 10 0	15 6	*2 15 0
Beaufort West ...	12 6	17 9	13 6	10 6	13 6	10 6	8 3	4 6	5 0	10 6	1 0	0 6	†0 5½	1 3	1 6	13 0 0	12 0	5 0 0
Capetown ...	8 6	—	—	—	—	9 0	6 8	4 3	7 0	10 0	‡0 5½	—	—	1 3	2 0	—	—	—
East London ...	9 6	18 6	29 6	8 0	14 9	7 0	6 0	4 6	6 0	15 0	1 0	0 4	0 5	1 3	—	12 0 0	18 0	1 8 0
Grahamstown ...	12 4	—	—	8 6	—	6 9	6 0	6 1	—	9 0	0 9	0 5	0 6¾	1 3	2 6½	—	—	2 10 0
Kimberley ...	12 0	15 6	15 0	11 3	11 6	9 0	7 3	5 0	5 0	12 0	0 6	0 6	0 5	1 1	2 6	11 10 0	13 0	4d. p. lb.
Kingwilliamstown	13 0	18 6	13 3	9 6	11 6	10 0	—	6 6	—	7 6	0 9	0 7	0 7	1 2	2 9	12 10 0	21 6	3d. p. lb.
Port Elizabeth ...	10 6	—	—	10 0	—	7 0	7 6	6 0	—	10 0	—	0 6	0 6	1 4	3 0	—	—	2 5 0
Queenstown ...	12 0	17 0	14 0	11 0	13 0	—	10 0	—	5 6	6 6	—	—	0 4½	1 0	2 6	—	—	—
Natal:																		
Durban ...	—	—	—	8 0	—	—	—	—	—	9 0	—	—	—	1 7	2 9	—	—	—
Pietermaritzburg	12 6	—	—	8 11	—	12 0	9 0	7 0	4 0	8 0	0 4	0 4½	0 6	1 5	2 9	—	—	—
Transvaal:																		
Pretoria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Johannesburg ...	12 0	—	13 6	10 6	9 7	9 0	8 0	6 9	3 6	8 0	2¼	—	—	1 3	1 5	—	—	—
Orange Free State:																		
Bloemfontein ...	13 0	—	14 0	11 0	—	11 0	10 6	6 6	4 6	6 6	—	0 6	0 4	1 3	1 9	—	—	—
Harrismith ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Average, £2. 10s. to £3. † Average, 5d. and 6d. ‡ Average, 4d. to 7d.

Importation of Cattle from Holland.

FOR the information of intending importers of cattle from Holland, we reproduce below a copy of the certificate of health which the Netherland Department of Agriculture has decided to adopt in respect of cattle, etc., exported from the disease-free areas of Holland to the Union of South Africa.

RIGHT. LEFT.



NETHERLAND DEPARTMENT OF AGRICULTURE,
INDUSTRY, AND TRADE.

I, Dr. J. Poels, chief of the service for the inspection of cattle for export from the Netherlands, hereby certify:

(*a*) That the animal, sketched above, being a black and white bull, three years old, bought from Mr. N. N., at X, Province of Y, of the Holland / Friesian breed, and destined for Mr. A., South Africa, has been examined and injected with tuberculin;

(*b*) that this animal has been found to be quite healthy, and, according to the return No.......... attached hereto, did not react to the tuberculin test:

(*c*) that no contagious disease of cattle has raged in the place of origin of the above-named animal and its neighbourhood since six weeks from this date.

(Signed) J. POELS.

Rotterdam,........................191...

Seen at The Hague,........................191...

The Deputy-Director-General of Agriculture,
(Signed) C. ROEST.

I further certify that the Province of Y was free from foot-and-mouth disease at the date given above.

The Deputy-Director-General of Agriculture,
(Signed) C. ROEST.

Outbreaks of Animal Diseases.

THE following outbreaks of scheduled infectious and contagious animal diseases have occurred in the areas specified during the month ended 30th April, 1913.

C. E. GRAY,
Principal Veterinary Surgeon (Union).

CAPE PROVINCE PROPER.

(EXCLUDING TRANSKEIAN TERRITORIES.)

DISEASE.	DISTRICT.	AREA OR NAME OF FARM.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Anthrax ...	Alexandria ...	De Hoek, Springmount	1	24	—	—	—	—	—	—
	" ...	Village...	1	5	—	—	—	—	—	—
	Barkly West ...	Cornforth Hill, Klipdam	1	Unkn.	—	—	—	—	—	—
	" ...	Delpoort's Hope	6	"	—	—	—	—	—	—
	Komgha	Farm 230 A	2	49	—	—	—	—	—	—
	"	Farm Section 21 xiii/38	1	18	—	—	—	—	—	—
	"	Farm Section 13 xiii/35	2	38	—	—	—	—	—	—
	"	Farm 236	1	36	—	—	—	—	—	—
	"	Farm Section 16 xiii/37	1	20	—	—	—	—	—	—
	"	Farm 332	1	57	—	—	—	—	—	—
	"	Farm Section 16 xiii/37	1	18	—	—	—	—	—	—
	"	Farm Section 18 xiii/37	1	21	—	—	—	—	—	—
	"	Farm Section 15 xiii/37	1	19	—	—	—	—	—	—
	"	Farm Section 19 xiii/38	1	19	—	—	—	—	—	—
	"	Farm Lot 4 xiii/33	1	18	—	—	—	—	—	—
	Mafeking	Farm Faith	1	350	—	—	—	—	—	—
	"	Farms Parnell and Hope	1	700	—	—	—	—	—	—
	"	Farm Steilhoogte	1	40	—	—	—	—	—	—

Anthrax ...	Taungs	Farm Zwartputs	1	Unkn.	—	—	—	—	—	—	—
	„	Farm Thoming	16	„	—	—	—	—	—	—	—
	Vryburg	Vryburg	1	„	—	—	—	—	—	—	—
	„	Vryburg	1	„	—	—	—	—	—	—	—
	„	Patrijsfontein	1	„	—	—	—	—	—	—	—
Glanders ...	Britstown	Britstown	—	33	1	1 Clin.af. & destr.	—	—	—	—	—
Tuberculosis ...	Oudtshoorn... ...	Paardebont	—	1	3	—	—	—	—	—	—
	Cape	Various	—	—	—	—	—	—	251	9	2
	Malmesbury ...	„	—	—	—	—	—	—	74	—	—
	Paarl	„	—	—	—	—	—	—	22	—	—
	Stellenbosch ...	„	—	—	—	—	—	—	71	1	—

NATAL.

East Coast Fever	Dundee Division	Mooidoornhoek	1	28	—	—	—	—	—	—	—
	Impendhle „	The Peak	1	1	—	—	—	—	—	—	—
	Ixopo „	Riverbend	5	191	—	—	—	—	—	—	—
	„ „	Quornkaba	—	—	—	—	—	—	—	—	—
	Klip River „	Glen Urquhart	—	—	—	—	—	—	—	—	—
	Richmond „	Insingosi	5	30	—	—	—	—	—	—	—
	Vryheid „	Strydplaats	3	43	—	—	—	—	—	—	—
Mange in Equines	Zululand	Eshowe	—	4	—	—	—	—	—	—	—
Epizootic Lymphangitis	Lower Umzimku'u...	Imbizana	—	15	—	—	—	—	—	—	—
Glanders ...	Vryheid Division ...	Vryheid	1 clinic affect. & destr.	No in-contacts	—	—	—	—	—	—	—
Trypanozoonosis (Nagana)	Zululand, Ndwandwe Division	Nongoma	1	—	—	—	—	—	—	—	—

TRANSVAAL.

Disease.	District.	Area or Name of Farm.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Re-tested.
Anthrax ...	Krugersdorp ...	Roodepoort	2	65	—	—	—	—	—	—
	Waterberg	Bokpoort No. 2630	1	84	—	—	—	—	—	—
	"	Vaalkop No. 722	1	36	—	—	—	—	—	—
	Witwatersrand ...	Elsburg	1	343	—	—	—	—	—	—
	" ...	Putfontein No. 24	1	50	—	—	—	—	—	—
	" ...	Rietfontein No. 8	1	51	—	—	—	—	—	—
	" ...	Rand Klipfontein No. 22	2	180	—	—	—	—	—	—
	Lichtenburg ...	Paauwkop No. 312	2	1000	—	—	—	—	—	—
	Standerton	Winklehaak No. 73	4	—	—	—	—	—	—	—

ORANGE FREE STATE.

Disease.	District.	Area or Name of Farm.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Re-tested.
Anthrax ...	Senekal	Brakfontein	5	300	—	—	—	—	—	—
Tuberculosis in Pigs	Winburg	Roodekop	1	—	—	—	—	—	—	—
	Thaba 'Nchu ...	Warmkloof	1	—	—	—	—	—	—	—

TRANSKEI.

Disease.	District.	Area or Name of Farm.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Re-tested.
East Coast Fever	Mount Currie ...	Whistlerock	1	150	—	—	—	—	—	—
	" ...	Rocky Ridge	1	70	—	—	—	—	—	—
	Kentani	Dixon's Location	1	91	—	—	—	—	—	—
	"	Swan's Farm, Teko	1	—	—	—	—	—	—	—
	Tabankulu	Makaula's, Mlahlwa's, and Vumani's Locations	—	—	—	—	—	—	—	—

	Nqamakwe ...	Benase's Location ...	1	74	—	—	—	—	—	—
	Mount Frere	Zibokwana's Location	1	40	—	—	—	—	—	—
	"	Mdayi's Location ...	1	32	—	—	—	—	—	—
	"	Mount Frere Commonage	1	322	—	—	—	—	—	—
	Butterworth	Skit's Location ...	—	—	—	—	—	—	—	—
Glanders ...	Port St. Johns	Hlamvana's Location	1	—	—	—	—	—	—	—
	Tabankulu ...	Tabankulu Village ...	6	20	2	18	—	—	—	—
Anthrax ...	Kentani ...	Kentani Village ...	—	—	—	—	—	—	—	—
	" ...	Centuli's Location ...	—	—	—	—	—	—	—	—
	" ...	Nthlangem's Location	—	—	—	—	—	—	—	—
	" ...	Nzanzana's Location...	—	—	—	—	—	—	—	—
	" ...	Villebaye's Location ...	—	—	—	—	—	—	—	—
	Engcobo ...	Engcobo Commonage	—	—	—	—	—	—	—	—
	" ...	Nqwenam's Location	—	—	—	—	—	—	—	—
	Butterworth	Nqari's Location ...	—	—	—	—	—	—	—	—
	Nqamakwe ...	Nobavida's Location...	—	—	—	—	—	—	—	—
	" ...	Benase's Location ...	—	—	—	—	—	—	—	—
	" ...	Sobekwa's Location ...	—	—	—	—	—	—	—	—
	" ...	Mkatehawe's Location	—	—	—	—	—	—	—	—
Lung-sickness ...	St. Marks ...	Sijabalada's Location	—	—	—	—	—	—	—	—
	Mquanduli ...	Sependu's Location ...	3	36	—	—	—	—	—	—
	" ...	Pangeleli's Location ...	4	36	—	—	—	—	—	—

Agricultural Show Dates, 1913.

Secretaries of Societies which propose holding shows during 1913, the dates of which do not appear in the following list, are invited to send particulars at the earliest opportunity.

TRANSVAAL.

Pretoria, 22nd to 24th May.
Rustenburg, 30th and 31st May.
Waterberg, 28th May.
Wolmaransstad, 4th and 5th June.
Pietersburg, 11th and 12th June.
Barberton, 11th July.
Klerksdorp.—No show owing to drought.

NATAL.

Vryheid, 6th June.
Ixopo, 19th June.
Umvoti, 20th and 21st June.
Alexandra, 24th June.
Pietermaritzburg, 25th to 27th June.
Durban, 2nd to 4th July (provisional dates).
Stanger, 9th July.
New Hanover, 10th July.
Richmond, 25th July.

Farm Employment.

NOTE.—***This section is open to persons desiring to obtain employment on the land, and to farmers who require farm assistants. Notices are inserted in several succeeding issues; and advertisers are requested to advise the Editor as soon as their requirements are filled in order that their notices may be deleted.***

SITUATIONS WANTED.

Management of farm wanted by experienced farmer; large and small stock and agriculture. Age 38. Ten years' South African experience.—M., Box 5230, Johannesburg. [3]

Applicant, 23 years of age, desires employment on farm as manager. South African born. Acquainted with general farming. Speaks Dutch and Kaffir, and English to some extent.—J. G. MAARTENS, P.O. Ida, via Indwe, C.P. [4]

Engine-driver wants job on farm; is used to shellers, thrashers, pumps, traction, etc Fair carpenter and all-round handy-man. Single.—C. A. RYALL, c/o Mrs. Heydenrych, 384 Schoeman Street, Pretoria. [4]

Employment wanted by Colonial, age 27, as manager or assistant on a farm. Has had good experience in stock and agricultural farming in Cape Province for years; also good knowledge of butter-making. Speaks both English and Dutch. Good references.—G. H., Box 18, Newclare, Johannesburg. [4]

Young man, with several years' experience both in stock and agricultural farming, desires situation as farm manager. Testimonials.—P. S. CAMPBELL, Fort Beaufort. [3]

Applicant, 30 years' experience in farming in South Africa in every branch, including ostriches, cattle, sheep, horses, general agriculture and fruit farming, wants position as farm manager. Speaks Dutch and English fluently. Excellent references.—Apply H. D. VILJOEN, 17 Pretorius Street, Pretoria. [5]

English woman, holding first class certificate in dairy work, and having many years' practical experience, wishes to obtain work in creamery. Would undertake the management of a dairy, or any suitable employment. Has lectured and demonstrated for county councils in England.—C. G., c/o *Agricultural Journal* Office, Pretoria. [5]

Applicant, 27 years of age, German, desires position on farm in Transvaal as general manager, on salary or salary and share basis. Brought up on farm in Transvaal. Has thorough experience of general farming, cattle breeding, and dry-land farming. Has at present a position as manager, and receives £20 per month.—J. H. F., Box 14, Grootfontein North, German South-West Africa. [5]

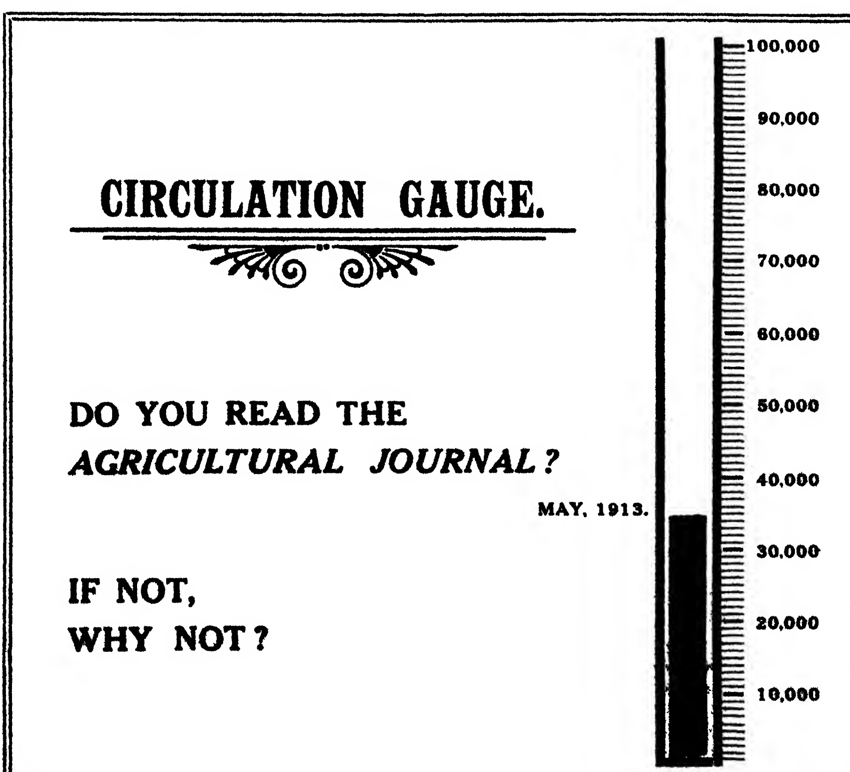
Situation wanted as farm manager by a steady, reliable, and hard-working man, 31 years of age. Has had 15 years' experience in every branch of farming, thoroughly understands the management of natives. Competent sheep judge. Holds best of testimonials. Apply, stating salary, to "RENNOX," Grasslands, Cathcart, C.P. [5]

Advertiser, with Free State, Transvaal, and Rhodesian experience, desires post as manager. Age 33, married, one child. Good references as conscientious, capable worker.—A. F., *Agricultural Journal* Office, Pretoria. [5]

SITUATIONS VACANT.

Opportunity for person with knowledge of gardening who would be prepared to cultivate, on his own account, portion of a farm in the Boshoff District of the O.F.S. Plentiful water supply and good soil. Terms to be arranged.—W., *Agricultural Journal* Office, Pretoria. [4]

Wanted, man with family on a farm where tobacco and cotton can be grown. All implements and draft animals will be provided. House with three rooms, and also a windmill on the farm. Communicate with J. TRICHARDT, jun., Mahabieskraal, P.O. Brakkloof, Rustenburg. [5]



Departmental Notices.

TOBACCO SEED.

The Tobacco and Cotton Division will have a quantity of selected and acclimatized tobacco seed of heavy and bright types for distribution about June, 1913. All applications for seed must reach the Chief of the Tobacco and Cotton Division, P.O. Box 516, Pretoria, not later than 1st May, 1913.

This seed will be distributed pro ratio at a charge of 1s. per oz. Each applicant will be informed soon after the 1st May what quantity can be supplied and the seed will be dispatched so soon as the cash is remitted.

Turkish Tobacco Seed: The following varieties of Turkish seed can be obtained from the Officer in Charge of Turkish Tobacco Experiments, La Motte, Paarl, Cape Province, at the prices quoted, viz.:—

Soulook	4s. per oz.
Malcadje	4s. „
Baladovari	4s. „
Dubeck	5s. „

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

CLEANING AND GRADING TOBACCO SEED.

The Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, are prepared to clean and grade tobacco seed sent to them by farmers free of charge.

The process separates the light from the heavy seed, and the result is that a much larger percentage of the cleaned seed will germinate.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

COTTON SEED.

Selected seed of several varieties of American Upland Cotton can be obtained from the Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, at a charge of 3d. per lb.

In every case a remittance must accompany the order for seed.

W. H. Scherffius,
Chief of Tobacco and Cotton Division.

VETERINARY RESEARCH LABORATORY, ONDERSTEPOORT.

Admission of Visitors.

It is hereby notified for the information of the public that visitors cannot be admitted to the Veterinary Research Laboratory at Onderstepoort during working hours on weekdays unless a special permit has previously been obtained from the Secretary for Agriculture.

The most convenient time for visitors to be shown over the Laboratory is Sunday afternoon, when an officer will be specially detailed for the purpose and permits will not be required.

EXPERIMENTAL FARM, POTCHEFSTROOM.

Seeds for Disposal.

Wheat.—Price 12s. 6d. per 100 lb. delivered at buyers' station. This price is subject to alteration without notice.

Early and Medium Early Varieties suitable for Irrigated Land.—Wit Klein Koren; Rooi Wol Koren; Spring; Glujas Early; Eckstein; Bombay; Fourie; Australian (Early); Hawkesbury; Egyptian Red.

These seeds consist of different varieties which have been experimented upon at this Farm, and have proved valuable; the crops thereof have been specially grown for seed purposes.

Application for these seeds should be made on or before the 15th March. No orders will be booked until that date, but applications may then be closed, and the available supply distributed pro rata among the different applicants. In that case only orders which have been

then definitely placed will be considered; an inquiry which is still the subject of correspondence will not be considered a definite order. These "seeds" will not be forwarded on the c.o.d. system.

Orders must be accompanied by remittance, and cheques and money orders should be drawn in favour of the Principal, Experimental Farm, Potchefstroom, from whom any further particulars may be obtained.

H. THOMPSON,
for *Principal*.

27th January, 1913.

PIGS FOR SALE.

Large white Yorkshire and Berkshire Pigs are for sale from the Tweespruit Stud Farm, P.O. Tweespruit, and large Blacks and Berkshires from the Roodepoort Stud Farm, P.O. Dewetsdorp. Inquiries should be addressed to the Managers of the farms mentioned.

ORGANIZATION OF DEPARTMENT OF AGRICULTURE.

Administrative Office ... ... Pretoria.
Telegraph Address ... ... "Landbouw, Pretoria."

Secretary for Agriculture: F. B. Smith. Under-Secretaries for Agriculture: P. J. du Toit and A. Holm. Deputy-Accounting Officer: J. Collie. Chief Clerk: G. N. Williams. Officer in Charge of Inquiry Office, Capetown: G. W. Klerck.

VETERINARY DIVISION.

This Division endeavours to prevent the introduction of contagious diseases of live stock into the Union and to eradicate such as are already present, and to protect live stock against enzootic diseases by inoculation and other means. So far as it is able to do so without interfering with its other duties, the Division advises and assists farmers upon diseases of stock generally and endeavours to enlighten them upon veterinary hygiene and the care of live stock. For veterinary purposes the Union is divided into five areas, each in charge of Senior Veterinary Officers, who are responsible for the control of disease within these areas.

Principal Veterinary Officer: C. E. Gray. Assistant Principal Veterinary Officer: J. D. Borthwick.

Cape Province.—Senior Veterinary Officer: R. W. Dixon, Government Offices, Parliament Street, Capetown. Government Veterinary Officers: C. S. Elphick, Vryburg; E. Fern, Capetown; A. Matthews, Capetown: G. W. Freer, Uitenhage; R. I. Jones, East London; J. H. L. Lyons, East London; J. Nichol, Kingwilliamstown; W. G. Pakeman, Queenstown; and W. A. Simson, Cradock.

Transvaal.—Senior Veterinary Officer: J. M. Christy, Department of Agriculture, Pretoria. Government Veterinary Officers: R. S. Garraway, Pretoria; W. G. Evans, Volksrust; P. Conacher, Johannesburg; J.G. Bush, Krugersdorp; T. H. Dale, Potchefstroom; H. M. Webb, Zeerust; J. M. Tate, Rustenburg; J. Chalmers, Nylstroom; J. I. Edgar, Pietersburg; G. Lee, Lydenburg; G. C. Webster, Barberton; D. B. J. McCall, Ermelo; and G. May, Standerton.

Natal.—Senior Veterinary Surgeon: W. M. Power, Colonial Buildings, Pietermaritzburg. Government Veterinary Surgeons: S. H. Ewing, Eshowe; A. F. Harber, Point, Durban; S. I. Johnston, Maritzburg; F. J. Hill, Bulwer; A. Goule, Maritzburg; J. L. Webb, Mooi River; C. Tyler, Ladysmith; and F. Hutchinson, Dundee.

Orange Free State.—Senior Veterinary Surgeon: A. Grist, Government Buildings, Bloemfontein. Government Veterinary Surgeons: J. F. Joyce, Ficksburg; J. A. A. Hamilton, Kroonstad; F. M. Skues, Bethlehem; C. H. Wadlow, Smithfield; and C. T. Clemow Frankfort.

Transkeian Territories.—Senior Veterinary Officer: J. Spreull, Umtata. Government Veterinary Surgeons: A. C. Kirkpatrick, A. M. Howie, T. M. Doyle, W. A. Dykins, A. Goodall, G. T. Henerson, and J. A. Worsley.

DIVISION OF VETERINARY RESEARCH.

The duty of this Division is the investigation of diseases of live stock with a view to discovering methods of eradicating them or of protecting animals against them. It examines and reports upon pathological specimens forwarded by the Veterinary Division and farmers and prepares vaccines and sera of various kinds, and also mallein, tuberculin, and other diagnostic and preventive agents.

Opportunities are offered to post-graduate students for the carrying out of special investigations and a great deal of educational work is performed by the Division.

The Division is in close touch with and is complementary to the Veterinary Division. Director of Veterinary Research : Dr. A. Theiler. Assistant Director of Veterinary Research : W. Robertson. Superintendent : E. Parkes. Professional Assistants : D. T. Mitchell, W. H. Andrews, D. Kehoe, F. Veglia, W. Jowett, G. N. Hall, G. A. H. Bedford, A. W. Shilston (Pietermaritzburg), and J. Walker (Grahamstown).

DIVISION OF SHEEP.

This office is charged with :—(*a*) Eradication of scab ; (*b*) improvement of pastora ndustries ; (*c*) the management of the Stud Sheep Farm at Ermelo ; (*d*) the improvement of the flocks maintained on the various Experimental Farms ; and (*e*) the control of the Field Cornets in the Transvaal Province.

Chief of Division : B. G. L. Enslin. Principal Sheep Inspector : A. G. Davison. Principal Sheep and Wool Expert : Charles Mallinson.

For the better carrying out of the work in connection with scab, the Union is divided into twenty-four areas in charge of Senior Sheep Inspectors ; these areas are in turn divided into 297 inspection districts, each in charge of an Inspector. In addition there are ten Inspectors employed on the railway lines for the prevention of the movement of infected stock by rail. There are also five whole-time Inspectors employed on certain large commonages.

A similar organization is adopted in respect of the improvement of sheep and wool.

Orange Free State Province.—Sheep and Wool Expert : J. F. McNab, Bloemfontein. Assistant Sheep and Wool Expert : A. V. M. Suter, Bloemfontein.

Cape Province.—Sheep and Wool Expert : W. M. McKee, Queenstown. Assistant Sheep and Wool Experts : E. V. Goddefroy, Worcester ; P. S. Taylor, Steynsburg.

Transvaal Province.—Western District Assistant Sheep and Wool Expert : A. M. Spies, Headquarters not yet fixed. Eastern District Assistant Sheep and Wool Expert : J. J. McCall, Cedara, Natal.

Natal Province.—Assistant Sheep and Wool Expert : J. J. McCall, Cedara, Natal. This area includes the East Griqualand District of the Cape Province.

Manager, Ermelo Stud Sheep Farm : A. G. Michaelian.

DIVISION OF ENTOMOLOGY.

This Division obtains and disseminates information relative to beneficial and injurious "insects." In collaboration with the Division of Plant Pathology, it administers the law relating to the introduction of plants into the Union and by the inspection of nurseries and other methods, it endeavours to control injurious "insects" present in the Union ; it is also responsible for the destruction of locusts.

Chief of Division : C. P. Lounsbury. Entomologists : Claude Fuller and C. P. v. d. Merwe, Pretoria ; C. W. Malley, Capetown ; ...., Bloemfontein ; and C. B. Hardenberg, New Hanover, Natal (investigating wattle insects).

DIVISION OF BOTANY.

This Division is concerned with the investigation of the merits of indigenous plants of economic importance and of poisonous plants and noxious weeds, the identification of plants, the introduction and testing of economic plants from abroad and the improvement of farm crops by breeding.

Chief of Division : J. Burtt-Davy. Herbarium Assistant : Miss C. Stent.

DIVISION OF PLANT PATHOLOGY AND MYCOLOGY.

This Division in engaged in the investigation and control of diseases of plants, produced by fungous and physiological causes, and the study and collection of fungi of economic importance.

Chief of Division : I. Pole Evans. Professional Assistants : Miss E. M. Doidge and P. v. d. Byl.

DIVISION OF TOBACCO AND COTTON.

The object of this Division is the promotion of the tobacco and cotton industries Experiments are conducted in the breeding and growth of tobacco and cotton and in the curing, fermentation, and preparation of tobacco for the market. Approved varieties of tobacco and cotton seed are distributed amongst farmers and advice given to them personally and by correspondence and publications.

Chief of Division : W. M. Scherffius. Tobacco Warehouse Expert: T. E. Elgin. Expert for Turkish tobacco, Western Province, Cape : L. M. Stella, "La Motte," Paarl. Manager, Experiment Station, Rustenburg : H. W. Taylor. Manager, Experiment Station, Barberton : W. B. Wilson. Manager, Tzaneen Estate : E. H. F. Powell. Manager, Experiment Station, Piet Retief : R. Falgate. Manager, Cotton Experiment Station, East London : D. D. Brown.

DIVISION OF DAIRYING.

This Division deals with all matters connected with the advancement of dairying. The Division also controls the Cold Stores at Vryburg.

Superintendent of Dairying: E. O. Challis. Senior Inspector:...............................
Instructors: *Cape Province.*—T. R. Carruthers, Government Offices, Parliament Street, Capetown, and C. Schmolke, Queenstown. *Orange Free State.*—W. Oosterlaak, Government Buildings, Bloemfontein. *Natal.*—..............................., Colonial Office, Pietermaritzburg. *Transvaal.*—L. J. Veenstra, Department of Agriculture, Pretoria.

DIVISION OF HORTICULTURE.

This Division advises farmers on the growing and marketing of fruit, including table grapes and raisin drying, and grades fruit for export.

Chief of Division: R. A. Davis. Horticulturist in charge of Experiment Station, Warmbaths: C. A. Simmonds. Horticulturist in charge of Experiment Station, Ermelo: R. le Sueur. Instructor in Horticulture, Cape Province: S. W. van Niekerk, Bovenvallei, Wellington.

DIVISION OF VITICULTURE.

This Division is charged with the duty of advising farmers in all matters relating to the culture of the vine (excluding table grapes and raisin-making) and the manufacture of wine and brandy, and vinegar. It conducts field investigations into the suitability of various stocks, the use of fertilizers, modes of cultivation, etc., and investigates the diseases of the vine, and conducts both cellar and laboratory experiments in the making of wine and brandy. It examines pathological specimens and furnishes reports thereon, and examines chemically and bacteriologically specimens of the products above mentioned with a view to furnishing advice thereon to farmers.

This Division also includes the Government Wine Farm, Groot Constantia, where advice can be obtained by residents in the Wynberg and Hout Bay areas.

Government Viticulturist: A. J. Perold, Œnological Station, Paarl, Cape Province. Manager, Government Wine Farm, Groot Constantia: T. L. Watermeyer.

OFFICE OF GUANO ISLANDS.

This office undertakes the conservation, collection, shipment, and sale to the public of the guano, seal skins, etc., obtained on the various islands belonging to the Union, and is charged with the administration of all matters connected therewith.

Superintendent: W. R. R. Zeederberg, 69 Strand Street, Capetown.

DIVISION OF CO-OPERATION.

This Division is engaged in promoting co-operation for the sale and purchase of agricultural products and necessities amongst farmers and in organizing and supervising co-operative societies.

Chief Inspector: C. H. Keet. Inspectors: J. Retief and H. Minnaar.

PLANTING SEASON, 1913.

SUPPLY OF FRUIT TREES BY AGRICULTURAL DEPARTMENT.

It is notified for general information that no fruit trees of any description will be available for distribution to the public during the coming season, but cuttings for grafting and budding purposes will still be obtainable at a nominal charge.

Office of the Administrator,
Capetown, 16th April, 1913.

TROUT, CARP, AND TENCH: SUPPLY OF.

It is hereby notified for general information that Carp Fry, Tench Fry, and Trout Fry or "Eyed Ova" will shortly be available for distribution from the Jonkers Hoek Trout Hatchery, Stellenbosch, on application.

All applications for fry or ova should be sent direct to the Curator, Trout Hatchery, Stellenbosch, *not later than the 31st August* in each year, and a duplicate thereof, together with the remittance and any correspondence relating thereto, should be sent to the Provincial Secretary, Capetown.

Notice of the dispatch of any consignment will be sent from the Hatchery by the Curator.

Applicants are requested to give their addresses in full, and also to name the railway station to which the fry or ova are to be consigned. In the event of the Trout Ova having to travel by post-cart, the nearest post office to the applicants' farms or homes, number of hours occupied on journey from post office to destination, and days of weeks on which mails are received, must be stated; also whether the fish or ova are required for river or dam.

It is to be particularly observed that after orders for fry or ova have been placed, applicants must be ready to receive such fry or ova at any time—

(a) In the case of Trout Ova after 1st June; and

(b) In the case of Carp or Tench after 1st May;

and that fry or ova can only be sent when the Curator is able to do so, and in such numbers as are available for dispatch from time to time.

Orders and addresses should not be changed or cancelled after the above dates.

In each case the Curator will, by wire or letter, give applicants due notice of dispatch of fry or ova.

Carp Fry will be supplied at 10s. per dozen, *Tench Fry* at £1 (one pound) per dozen, *Trout Fry* at the rate of £2 (two pounds) per thousand, when available, *payment to be made in advance.*

The Department will not be in any way responsible for fry or ova after delivery to the railway authorities at Stellenbosch Railway Station.

The purchase of Trout Fry is not recommended on account of the risks attending transport.

In case of Carp, Tench, and Trout *Fry* an additional charge of 5s. will be made for transport to Stellenbosch Railway Station, together with 25s. for the carboy or carrier in which the fish are forwarded; the latter amount will be refunded on return of the carboy intact to the Railway Station at Stellenbosch.

Trout Ova (eyed ova), packed in moss, will be forwarded by parcel post to any address at a charge of £1 (one pound) per thousand, plus a charge of 5s. per parcel containing 1000 to 3000 ova, to cover cost of packing, postage, etc., to places *within the Union.*

On consignments to places *outside the Union of South Africa* there must be added to the above whatever extra charge may accrue for postage, railage, etc., according to tariff. *Payment must in all cases be made in advance.*

Remittances to be made by money order, postal note, or bank draft, payable to the Provincial Secretary, Capetown.

Hatching Boxes, capable of hatching up to 3000 fry, may be obtained from Mr. WILLIAM LOW, 64 Dorp street, Stellenbosch, at a charge of £1. 15s. (one pound fifteen shillings), delivered on the railway. All correspondence and payments in connection with this matter must be sent direct to Mr. Low.

Printed pamphlets containing full instructions relative to the Hatching of Ova, the Construction of Hatching Boxes, the Treatment of Carp, Tench, and Trout Fry, will be forwarded *free of charge* on application to the Provincial Secretary.

Government Notice No. 93 of 1912 is hereby cancelled.

NOEL JANISCH,
Provincial Secretary.

IMPORTATION OF POTATOES.

The following Government Notice is published for general information.

F. B. SMITH,
Secretary for Agriculture.

Department of Agriculture, Pretoria.

The restrictions under the Agricultural Pests Act, 1911, on the introduction of potatoes into the Union from oversea places and from non-British places within South Africa are expected to remain during the 1913–14 importing season substantially as they were during the 1912–13 season.

The chief alteration proposed for application during the coming season provides that packing material such as lime, corkdust, wood-wool, and paper shall be removed from boxes and that ventilation as by the removal of portions of the sides shall be given if the containers as received are inadequately ventilated. A special fee of 2d. per case is to be levied if either of these services is necessary. The use of practically air-tight boxes for the

shipment of potatoes appears to be very deleterious to the contents, and the use of packing material appears to be quite unnecessary. Nearly all of the boxes in which potatoes were imported in the past season were satisfactorily ventilated and contained no packing material, but some consignments arrived in boxes without any provision for ventilation or with only a few auger holes.

All consignments will be inspected. If in any package any pathogenic bacterial disease, such as Black Leg or Stem Rot caused by *Bacillus phytophthorus* Appel, or the decay caused by *Bacillus solanacearum* Smith, *Bacillus solanisaprus* Harrison, or *Bacillus melanogenes* Pethybridge, is found, that package and also all packages bearing the same marks in which 15 per cent of the tubers are decayed will be excluded from entry; while packages in which under 15 per cent. of decayed tubers are found will be passed providing no trace of the bacterial disease is found in them. If Black Scab or Warty Disease, caused by *Synchitrium endobioticum* Percival, is found in a package, every package bearing marks similar to that one will be excluded. Packages will not be excluded because of insect injuries, uninfectious scabs, Oospora scab, Rhizoctonia, Phytophthora blight, Fusarium decay, or non-pathogenic bacterial rots; and the Government will exercise its prerogative to reject infected packages on account of diseases other than Black Scab and pathogenic bacterial diseases only in case there is discovered a trouble which there may seem particular reason to fear.

All consignments will be fumigated with formaldehyd gas and, in general, without removing the potatoes from their containers. Should a box not be open for at least half an inch along the angles of opposite sides, portions of two or more sides will be broken away or vents otherwise provided to facilitate the diffusion of the gas, and should cork-dust, lime, or other material be included as packing, it will be removed and may not be replaced. It is earnestly recommended that well-ventilated cases be used as containers and that packing be omitted.

A fee of 6d. or 1s. per package will be charged for the fumigation according to whether the invoiced weight of the contents is (*a*) 100 lb. or less or (*b*) over 100 lb. A further fee of 2d. per package will be charged if additional ventilation has to be provided or if packing has to be removed.

The documentary requirements with respect to Black Scab or Warty Disease remain exactly as they were last season. A sworn statement by the consignor, identifying the packages and setting forth the place of origin of the potatoes, is necessary with each consignment. In addition a statement from the Department of Agriculture or other officially authorized institution of the country of origin, certifying at a date within thirty days of the shipment that Black Scab has never been known to exist within five miles of the declared place of origin, is necessary unless (*a*) the Government of the country of origin has assured the Union Government that Black Scab has never been known in its territory and has promised to report any outbreak, or (*b*) unless the consignee produces a statement from the Department of Agriculture or other authorized institution of the country of origin, certifying at a date within nine months that no case of Black Scab has been known in the county, shire, department, or other such territorial division within which the declared place of origin is situated. France is the only country which has given the assurance and promise specified in (*a*), and it follows that an official certificate is not required with a consignment declared to have been grown in France, but that one is required with a consignment declared to have come from any other country inclusive of any British possession outside of South Africa. An official certificate cannot be accepted if the place named in it as the place of origin fails to correspond with the place named in the consignor's declaration, and consignors are cautioned that a certificate cannot be accepted if it is from an institution which the Union Government has not agreed to recognize for the issue of certificates. Much inconvenience to consignees has arisen in the past through certificates from local government bodies, police administrations, and chambers of commerce being sent by consignors in place of certificates from national departments of agriculture or institutions formally recognized in place of them.

It is recommended that the consignor's declaration have the following form:—

CONSIGNOR'S DECLARATION.

Address.

I, the undersigned..member of the firm of.., consignor of........................cases, each containing..............................net weight of potatoes for...............................purposes and marked..............................., to be shipped per steamer........................ from..to..

do hereby declare that the potatoes herein referred to were all grown at..........................
....in the district of...
in..

(Signed)..

Declared at...this...................................
day of..191..., before me.

....
(Name and Title of Officer administering Oath.)

It is recommended that the official certificate have this form :—

OFFICIAL CERTIFICATE *re* BLACK SCAB.

The undersigned, under authority of the Department of Agriculture of......................
....................................hereby certifies that the potato disease known as Black Scab or Warty Disease and ascribed to the fungus *Synchitrium endobioticum* Percival, has not, as far as is known to the Department of Agriculture, been known to exist within five miles of ....in the district of..

Signature...
Title..

Address..
Date and official stamp or seal.......................

A consignment will not be released on any pledge that a missing document will be submitted later, but the release can be expedited by satisfactory cable messages through strictly official channels. A comprehensive certification by cable from an oversea department of agriculture to the Secretary for Agriculture ("Landbouw, Pretoria"), would be honoured as the required official certificate, and an official certificate or a consignor's declaration would be honoured in advance of its receipt in South Africa if it were transmitted from London through the Trades Commissioner of the Union (attached to the Office of the High Commissioner), and a cable dispatched through this officer in which the consignment were identified, the place of origin named, and an intimation given that the document or documents being transmitted satisfied the requirements of the regulations. Care should be taken to have the name given to the place of origin in one document correspond with that given in the other, and a cabled message from which the name of the place of origin is omitted is likely to fail to connect a consignor's declaration with the official certificate intended for the same consignment.

No "phylloxera declaration" is required in connection with potatoes or other produce introduced into South Africa.

Any consignment of potatoes that enters the Union through Komatipoort will be inspected and fumigated at Pretoria or Johannesburg, no facilities being provided at Delagoa Bay or at the Portuguese border. As any extra carriage thus necessitated must be borne by the importer, the introduction of potatoes from oversea through Komatipoort is inadvisable.

Inquiries with respect to the restrictions on the introduction of potatoes should be addressed to "Chief of Division of Entomology, P.O. Box 513, Pretoria."

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Editorial Notes.

A pretty story is recounted of a dying vine-dresser who told his sons of certain treasure hidden in the vineyard, which they would discover after his death. The sons after a thorough search failed to find the jar of gold that they had expected, and were consequently sorely disappointed. But the treasure was there, nevertheless; and the fact dawned upon them when they found that the yield of the vineyard was doubling itself. The vine-dresser had realized that the nourishment absorbed by the roots of plants can be considerably increased, and the yield correspondingly enhanced by deeper cultivation; he understood, in fact, the principle of the adage that "well ploughed is half manured." The treasure that the vine-dresser set his sons to seek is a treasure that lies in all our fields; generally we manage to extract a little of it, but there is much left of which we may avail ourselves if we will go to the requisite trouble. And the "Open Sesame" in response to which nature will render unto us portion of these latent stores of wealth is *Deep Ploughing*—deep ploughing efficiently performed.—*Natal Agricultural Journal*, Vol. X.

In Sub-Tropical Natal.

If you take the 6.17 train from Durban for Port Shepstone on any fine morning you will be jogged comfortably along through some of the prettiest scenery in South Africa—scenery that, although it does not rival the wild ruggedness of Waterval Boven or the Hex Mountains, is nevertheless alluring because of the suggestion of the tropics which the wonderful variety and luxuriance of the vegetation, the brilliance of the sunshine, and the blueness of the sea—that in parts lashes a shore spread at your very feet—call up. In the first stages of the journey there are few open spaces. Rolling fields of sugar-cane and patches of bush succeed each other for miles, giving way only here and there to a clearing for cultivation. Then, with bush and the sea on the left, open spaces begin to appear on our right, broadening as we proceed; and, studying the veld thus revealed, we marvel at its indications of richness and at the wonderful agricultural possibilities of this part of the country. Greater grow these wide, untilled

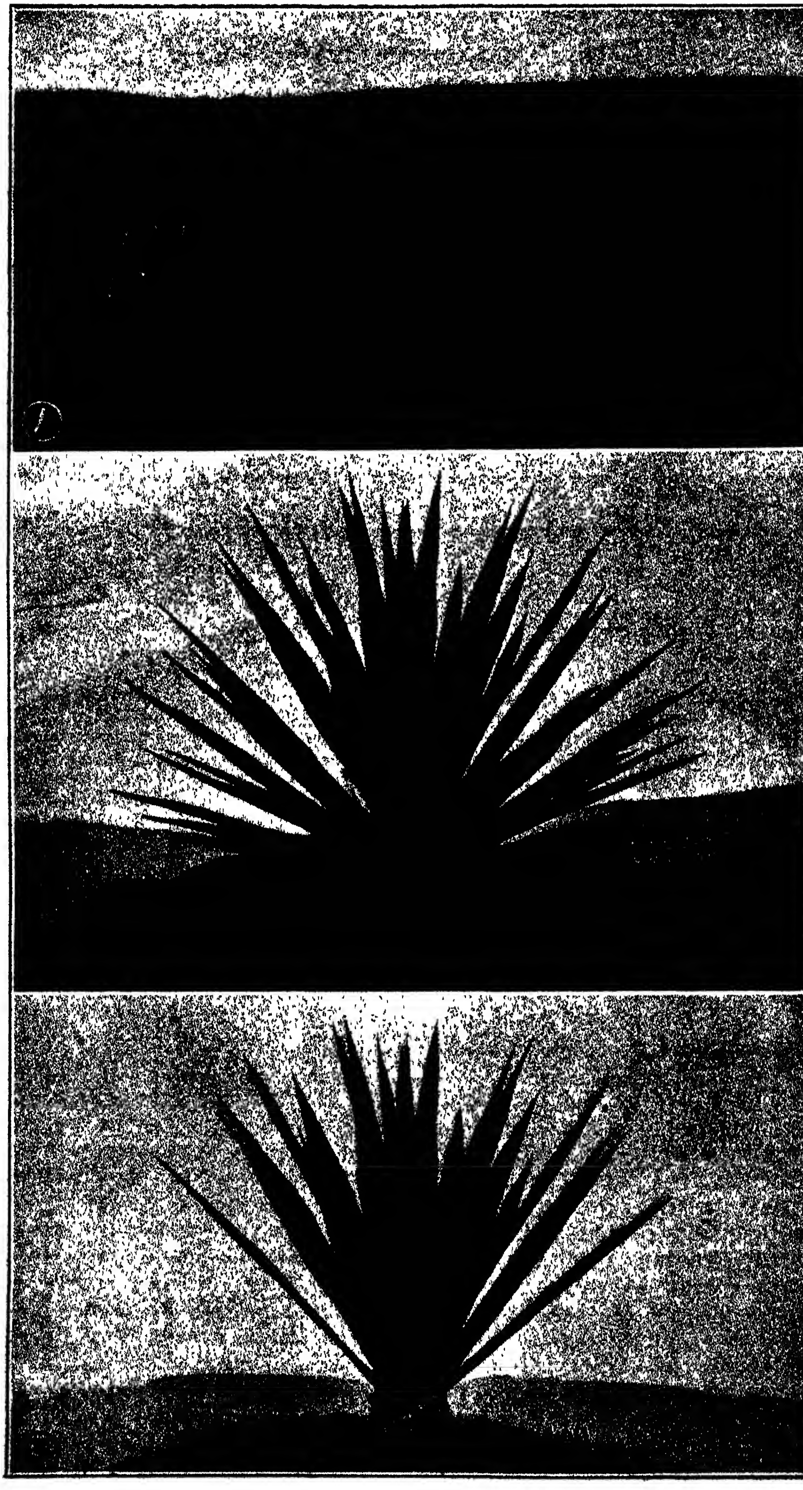


Plate No. LXII. ON A NATAL FIBRE ESTATE.

1. A sea of "Aloes." 2 and 3. How the plant is cut: Before and after cutting.

spaces as we journey southwards, and shortly before midday we approach Port Shepstone, nestling around the landlocked mouth of the Umzimkulu River.

Recently we made this interesting journey to the southern part of Natal. But our destination was beyond, and after a short wait we entrained about midday on the little narrow-gauge line that acts as a feeder of the main line for the country between the terminus and Paddock. An eight-mile run, occupying over half an hour, through gently hilly open country that reminded one of the country one passes through in approaching East London, and we found ourselves at our destination—Izotsha.

The Home of Fibre.

About four miles from Izotsha and ninety from Durban is situated Woodcroft Estate, the home and scene of the labours of Messrs. Manning and Collison, the leading fibre growers of Natal. A letter from Mr. Claude Manning, the senior partner, appeared in our April issue, and it was as the result of a private note enclosed in this that we found ourselves, camera in hand, on a sunny afternoon towards the end of April among the Furcræa fields chatting with Mr. Manning.

Before we proceed to give Mr. Manning's views on fibre growing as an industry for South Africa, a few words about the past of the industry are necessary. For fibre undoubtedly has obtained for itself a bad name in Natal. Yet an examination of the work that is being done on the Woodcroft Estate and the results that are being obtained is sufficient to convince the most pessimistic that the fault in the past has not lain with the fibre plant itself. Mr. Manning touched on the weak spot in his letter in the April issue, and the facts which he gave us personally during our conversation were sufficiently convincing that, given good business management, suitable machinery, and the right soil and climate—all of which, we were able to observe for ourselves, were fully evident at Woodcroft—there is no reason whatever why a great industry should not be built up, not only on the south coast of Natal, but in other parts of South Africa where climatic and soil conditions are suitable.

As a fibre estate Woodcroft has been running for a little over twelve months, and there are now some three hundred acres under crop. Cutting has been in process for some time, and the scene on the estate was wonderfully inspiring in its activity. Working in shifts, milling operations commence at three o'clock in the morning and cease at about six in the evening. Messrs. Manning and Collison are active managers, being up with the first shift in the morning.

Around the Woodcroft Estate.

Our first move was to look around the estate. It was a wonderful sight with its great fields of dark-green "aloe" plants stretching away down into the valleys and over the hills beyond. In a few places the older plants had "poled," sending up the tall, stout shoot the head of which blossoms into a bunch of white flowers that later develop into the miniature plants—known as "bulbils"—used for propagation. Here and there a road branched off from the wide main

Plate No. LXIII. ON A NATAL FIBRE ESTATE.

4. After cutting the spines are removed and the leaves tied up in bundles ready for carting. 5. A cart-load for the mill. 6. The mill.

one we were following, leading through the fields to the points where cutting was proceeding, for, when the land is planted, no provision is made for roads save a main one or two, the branch roads being cut through the fields in any direction necessary. The stumps, being soft, offer no obstruction to traffic. We went on to the mill, overtaking on our way carts laden high with bundles of freshly cut leaves, and on our arrival we were able to watch a cart off-loaded and the leaves disposed of. These were carried to a native, who, mallet in hand, crushed the heavy butts of the leaves on a block before him in order to render the process of milling easier. The crushed leaves were then fed by an "umfaan" through a window on to a table inside the mill.

Entering the mill we encountered great piles of fibre and two machines at work. One of these was the mill proper, a double raspador, which beats off the pulp from the leaves, leaving a handful of wet fibre. Here two Indians were hard at work taking one leaf at a time and subjecting each half in turn to the beating of the rapidly revolving knives. The wet, gummy fibre was then being taken to great wooden tanks outside, where a process of washing in hot and cold water cleaned the strands. Mr. Manning then led us to the drying field, where the fibre goes after the washing process. Here we found dozens of long lines of fibre hung over frames, and a wonderful sight it was! Lower down we found tow being similarly treated—of which more anon. When the fibre is dry it is taken to the second machine we observed in the mill, the scutcher. This machine works on the same principle as the raspador or decorticator, and its object is to clean the fibre, removing any roughness from the strands. Now the fibre is ready to be baled for the market, and for this purpose an ordinary large hay-press is brought into requisition.

We now went back to the decorticator to study the disposal of the pulp that is removed by the machine from the leaves. The yellowy-green scum is placed in trucks and run outside the mill, where, by means of a fork, the masses of short and broken fibres are removed. This is the tow of commerce, and after being washed and dried it is ready for market. The scum is then run on some distance and tipped out of the trucks on to a waste piece of land, where it is left to dry, being afterwards used as manure.

A "Fibre" Interview.

Having thus observed all the processes of fibre production, we now put a few questions to Mr. Manning.

"What capital do you consider is necessary for a man starting in fibre growing?" we asked.

"Should a man wish to plant his own aloes," Mr. Manning replied, "and mill his own fibre, I do not think less than 100 acres would suffice to give him an income to live on—comfortably, of course. For that acreage an outlay of £1000 would be required to bring the crop up to time of first cutting from initial breaking of the soil. Machinery, mill, and other equipment would take up £2000, so that I should not recommend any one with less than £3000 to take up aloe planting in South Africa. Planting for a central mill would, of course, be a totally different proposition, and the small capitalist with

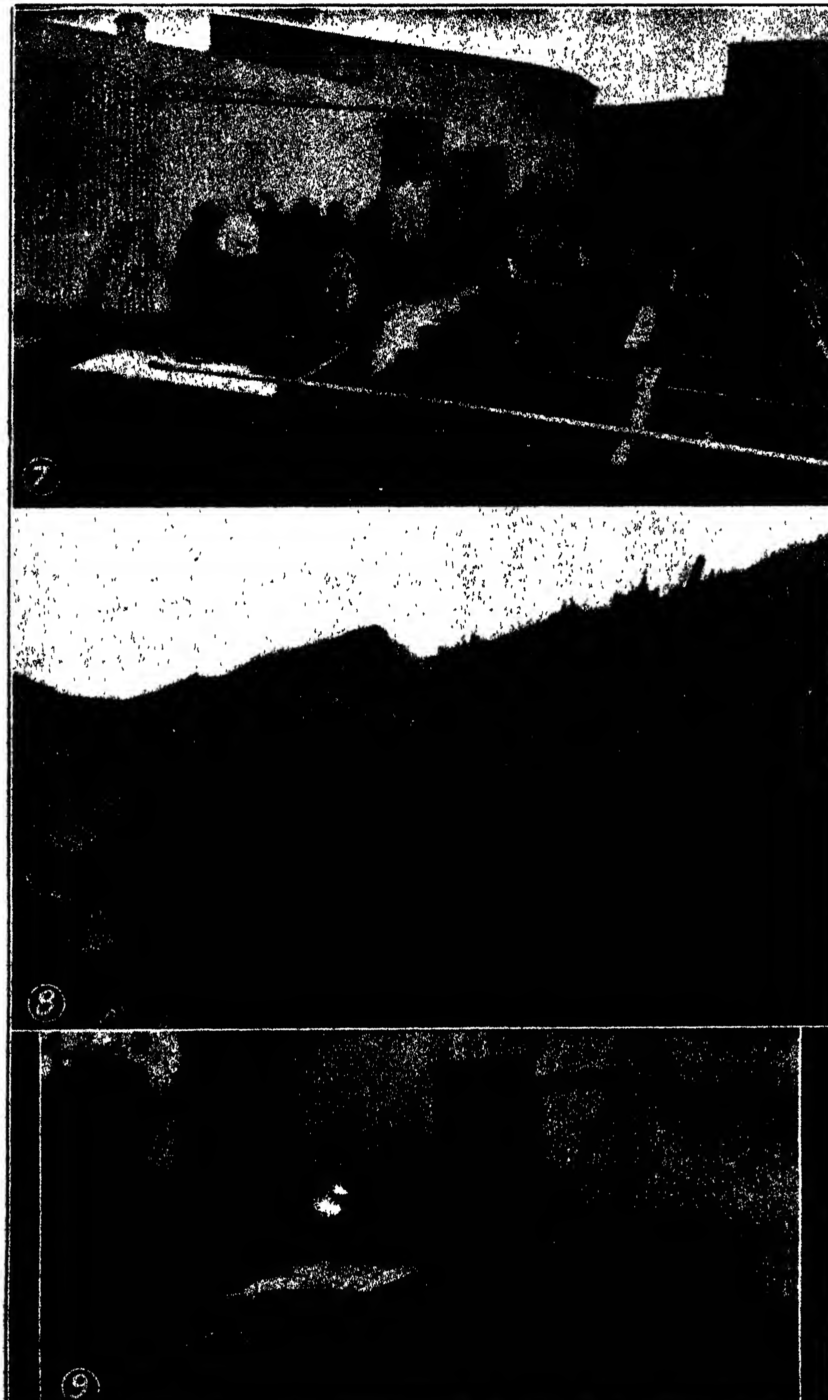


Plate No. LXIV. ON A NATAL FIBRE ESTATE.

7. The washing tanks where the fibre is washed after decorticating. 8. After washing the fibre goes to the drying yards, and thence to the scutcher, where roughnesses are removed from the strands. 9. The refuse (pulp, etc.) from the decorticator is run out in trucks and deposited away from the mill to dry and afterwards be used as manure.

a few hundred pounds should, under this system, make a very good living indeed."

"Did you choose the coast because it is the best for fibre cultivation, or for quite different reasons? What I mean is, would it be possible to establish the industry and run it successfully in the inland portions of South Africa so far as climatic conditions are concerned?"

"We chose our present locality after extended observation of the climatic conditions prevailing on the coast lands of Natal. The temperature here is most equable, and frosts and hail are, practically speaking, unknown in this district. I am afraid aloe planting could not under any circumstances be taken up in the inland districts of South Africa owing to the prevalence of hail and severe frosts, but where these do not occur, in the low veld—where there are no swamps, of course—there is no reason why aloes should not thrive well."

"What fibre plants do you consider most likely to be profitable in Natal, and which kind do you personally prefer, judging from your own experience?"

"The Furcræa aloe will undoubtedly thrive better and be more successfully grown in South Africa than other varieties, such as *Sisalana rigida* or *Sanseviera*, etc., which are better adapted to the tropical heat and moisture of Central and East Africa, where, however, the Furcræa grows too rank and carries too much pulp. The price, also, of the aloe fibre we grow from *Furcræa gigantea* is higher on the London market than the other fibres I have mentioned."

"What is the minimum rainfall required, so far as you know?"

"One of the great assets appertaining to aloe growing," Mr. Manning said, "lies in their requiring little rainfall and being able to stand, without damage, any shortage of a normal rainfall. For instance, the exceptionally severe drought through which we have just passed had no ill effect whatever on our aloe plantation."

"What class of soil do you find most suitable?"

"A porous soil is best for aloes. They also grow well on lands abounding with grit of a stony nature where soil intervenes, but clay soils or marsh lands are highly detrimental to the plant."

"What procedure do you follow in planting—preparation of the soil, marking out the rows, and so forth?"

"After well ploughing and harrowing the soil, young plants or bulbils, a year old, should be put in the ground a few inches deep in rows 5 feet by 5 feet square, so that the lines from any aspect would run straight. Under this system an acre will carry 1765 plants. We make our minor roads and tracks through the plantation as we cut the aloes, so that there is little waste land out of cultivation until the crop is reaped. Pony ploughs should be used while the plants are small to cultivate the land; thereafter the aloes protect themselves. I might add that it is of the greatest importance that the young plants or bulbils should be a year old before they are transferred from the nursery to the plantation. This ensures cutting in four years from time of planting."

"Do you require manure, and what fertilizers do you find the best?"

"So far we have not found manures to be necessary on our fields beyond the fertilizers we applied to the mealie crops we grew between our aloe fields in their early stages, but the débris, refuse of pulp, etc., from the aloe leaves as they pass through the decorticators will

Plate No. LXV.

ON A NATAL FIBRE ESTATE.

10. The product, before baling. 11 and 12. A leaf and its product.

serve as a splendid renovator to the soil if applied to the lands before planting further, or to the roots of the established plants. This is an asset of great importance."

Machinery for Fibre.

"What machinery do you find most profitable to invest in for the extraction of the fibre from the leaves on an estate the size of yours? What would you recommend a beginner to go in for in this respect?"

"For an area of 100 acres of aloes two single raspadors will be required. For larger plantations of 500 acres and upwards large automatic decorticators of the New Corona or Prieto type must be employed. We are using a double raspador and a single, which give us daily half a ton of prime fibre ready for further treatment—washing, drying, scutching, etc."

Awaiting shipment.

"What would be the cost, landed at, say, Durban, of such machines?"

"A single raspador costs at the Umgeni Engineering Works, Durban, approximately £100; a double raspador imported from Krupp, Magdeburg, Germany, costs, with freight, customs duty, etc., £150. The advantage of having these hand-fed machines made by the local firm referred to lies in the quick construction to order and in being able to procure immediately spare parts, etc., if there should be a breakdown. Automatic decorticators, such as the New Corona, cost at the works £750 for No. 1 size with a capacity of, say, 1½ tons of fibre a day."

"Is there any other machinery required?"

"Power, whether steam, water, or suction gas (former for preference), will be required, shafting, pulleys, belts, etc., a scutching or brushing machine for polishing the dry fibre, a baling press, a pump if necessary, and piping for general use, as washing fibre, etc. For dealing with half a ton of fibre per day at least six washing tanks will be needed—wooden for preference."

"What buildings are necessary for a beginner—that is to say, a man starting on his own account?"

"He would require a mill building, approximately 70 feet by 70 feet, and about 17 feet high. This will deal with an output of from half to three-quarters of a ton of fibre daily. A drying yard, with rails, is essential, with shelter fence to prevent high winds from blowing the dry fibre off the rails. A good supply of clean water is a *sine qua non*—a supply of, say, 1500 gallons per hour."

"What size of bales do you find the most convenient?"

"Bales weighing from 350 lb. to 400 lb., and measuring 3 feet 8 inches by 3 feet by 2 feet, are the best commercial size."

Mr. Manning added that, roughly speaking, the profit per acre was, they had found from practical experience, £10 net, but, of course, this profit must necessarily be subject to fluctuations of the market, the quality of the fibre produced, and the economic conditions observed throughout the whole business as regards cost of labour and the efficient manipulation of same. "The failure to carry out these important factors to ensure success in the past history of fibre production," Mr. Manning observed, "lay at the root of the collapse of former companies."

Another New Industry.

From Izotsha we journeyed back to Durban, and on our way to the Natal Agricultural Union's Annual Conference at Maritzburg we broke our journey at Gillitts in order to spend a few hours with Captain Herbert Noyes, who contributed the interesting and instructive article on rubber which we published last month. It was a striking set of circumstances that enabled us to turn from Mr. Claude Manning, of Izotsha, to Captain Herbert Noyes, of Gillitts, for what Mr. Manning is doing for fibre Captain Noyes is accomplishing for the establishment of a rubber industry. Both ventures are in their infancy; both have wonderful potentialities. In the one case a plant is being exploited that has been proved years ago to grow to profusion in certain parts of Natal; in the other case an indigenous tree is being made to yield a commercial product.

Rubber production is no new idea in South Africa. Hitherto, however, it has been confined to the extraction of rubber from vines growing in native forests in areas remote from civilization: it has been a matter of exploiting a wild plant, with little or no idea of replanting. Captain Noyes' proposition is a different one. In the hot, moist valleys in certain parts of Natal there is to be found growing in quantities a peculiar tree without foliage, in which a kind of spine takes the place of leaves. The tree is known botanically as ***Euphorbia tirucalli***, and it is this plant to which Captain Noyes has turned his attention.

Captain Noyes is a gentleman with a large experience of rubber-growing in the East, particularly in the Federated Malay States,

where he watched the industry grow from small beginnings to its present large proportions. He has had occasion several times during the past ten years to visit Natal in connection with rubber prospects in that part of the Union, and it was on the occasion of one of these visits that he came across specimens of the *Euphorbia tirucalli*, and, on investigating further, he became convinced of the excellent prospects of the establishment of an export trade in tirucalli rubber. We need not detail all the negotiations which necessarily followed, but it will suffice to say that syndicates were formed and concessions were obtained, first in the Tugela Valley, and later in the Inanda. Captain Noyes is now manager of the latter concern.

The Prospects for Natal Rubber.

From what we learned during our interview with Captain Noyes it appears that there is practically an unlimited demand for tirucalli rubber, and when it is mentioned that this rubber does not come into competition with the ordinary commercial article it will be realized what a future there is for South Africa in so far as this industry is concerned. Captain Noyes showed us a glowing report by the world's leading authority on rubber, in which it was stated that many hundreds of tons per month of tirucalli rubber can be employed in various industries, e.g. in the manufacture of electric cables and insulating materials, for asphalte mixings, for paints, artificial stone and other road and building materials, and for making plastic masses generally. "I think I am conservative in estimating," the writer of the report states, "that the rubber trade alone should take at least 500 to 1000 tons per annum, apart, of course, from any rubber you might obtain from deresination." He adds that a conservative estimate for the electric industry would be from 500 to 1000 tons. For asphalte making it is a question of thousands of tons, not hundreds; and thousands of tons would be required for artificial stones and road and building purposes. The report goes on to say that South Africa has practically a monopoly of the known supply of tirucalli rubber, and that the price should range from 5d. to 6d. per lb., and even more. "So far as I am aware," the report sums up, "the character of your enterprise is absolutely unique. . . . It is obvious that the scope of the entire business should prove a very large one."

Labour for Rubber Production.

We asked Captain Noyes whether he found the natives a satisfactory source of labour supply.

"I find the best labour," he replied, "is native umfaans from 12 to 16 years old, with one or two headmen to oversee. All the tapping can be done by such boys. I think I have got far better results from small boys. Our rule is that they shall bring in a minimum of fifteen pounds of latex per day, and for all over that amount we pay extra. By adopting this plan we have had boys bring in up to thirty pounds a day—in fact," Captain Noyes added, "many find the business as remunerative as working on the Rand, and there is the additional attraction of being near their homes."

Captain Noyes went on to say that the present position of the industry is similar to that in which the early wattle-growers found themselves. Then, for a while, as now, the manufacturers were not assured of a regular supply.

Among various other points of interest we learned that the *Euphorbia tirucalli* grows anywhere, even among rocks, and that, with careful tapping, the trees will live quite as long as the Para and Ceara from which the ordinary rubber of commerce is obtained. According to Captain Noyes' calculation, a tree four years old will be worth two shillings a year.

A Short-sighted Policy.

There is one point mentioned by Captain Noyes that calls for a word of warning, and that is the practice of certain rubber companies in Natal that, following Captain Noyes' lead, have been established, of mixing the latex from different kinds of rubber-producing trees. It may not be generally known that there are several trees in Natal which yield rubber in varying quantities, and it appears that it is the practice of some of the managers of rubber estates to mix up the latex from these various trees under the impression that "rubber is rubber," and that the coagulated composite product must realize good prices simply because it is "rubber." They fail to realize what every progressive maize grower or fruit exporter regards as one of the foundation stones of success, namely, that the mixture of different kinds and grades is bound to lower the price as well as reacting unfavourably upon the local industry. Let tirucalli rubber be tirucalli rubber and nothing else, and let it be sold as such, keeping the products of other trees separate and correctly described. Only thus can an export trade that shall be lasting be built up. We apparently have indigenous rubber trees in quantity, and we have a large market before us, but we can only properly develop the industry by careful attention to those details which in other industries connected with the land are considered to be the essentials of success.

More about Veld-burning.

We are pleased to observe that our editorial in the April issue on the evils attendant upon veld-burning has attracted some attention, and we print in this issue two letters on the subject which are well worthy of careful perusal as thoughtful contributions to our knowledge of this question.

The subject of veld-burning is a large one, the importance of which is realized by but few. Such important ultimate issues are dependent upon it that the widest discussion of the problems connected with it is to be welcomed. That there are considerable problems dependent upon it is evident to any one who glances over the many differing conditions to be found in various parts of the Union. We have, for example, the presence of *steekgras* in certain areas which, if allowed to seed, is highly injurious to sheep because of its sharp, arrow-like seed-heads which work into the wool and eventually into the skin of the animal. In order to obviate the dangers attendant

upon seeding, at the present time the only practicable means is to fire the grass just before it reaches maturity. In other words, we have to choose the lesser of two evils. Then, again, we have in Natal a Province whose conditions so far as can be seen at present do not permit of a complete abandonment of veld-firing, though it is probable that in many areas the discarding of this practice could be done with much future advantage to those concerned. There are such isolated cases to be met with which call for careful study, but, at the same time, there are very extensive areas throughout the Union where there is little doubt that the present practice of burning is not only highly detrimental to the veld, but tolerates no excuse for its practice. Such areas as these, it has been proved by experience, steadily improve with close cropping, and in the absence of firing the grasses thicken and the finer and more nutritious kinds gradually come to assume their proper place in the economy of the veld.

An example of the problems peculiar to limited areas in the Union is stated by our correspondent, "Natal Coast," who observes: "Our heavy tambuti lands give a good grass when burnt off and young, but as soon as it is old enough nothing can be done with it but burn it, and it could not be kept eaten down or mown"; and, again, as a collateral problem, that, with the disappearance of ticks, farmers are burning less frequently, with the result that most of their "best veld is being ruined by scrub springing up all over the country." As our correspondent points out, and as we are aware, periodical burning solves the difficulty—*for the present*—in that grazing is provided for the stock, but this burning must gradually kill out the most nutritious grasses and thus lessen the stock-carrying capacity of the veld, which simply means that, taking the value of the land to remain stationary (which it does not), the annual interest on that capital value must diminish; and it diminishes even more rapidly when we consider the gradual rise in land values which is necessarily steadily taking place in most districts.

The Veld and Grass-seeding.

Mr. Skottowe's contribution to the discussion is a very thoughtful one and contains some valuable points. In particular we should like to refer to his remarks with regard to the question of seeding and its influence on the coarsening of the veld. Mr. Skottowe strongly condemns any practice which may give grasses an opportunity of seeding (in which he is supported by "Natal Coast"), and we are inclined to agree with him.

But if the balance of the grass not consumed by the grazing stock is made into hay, seeding cannot take place, and, in addition, a certain amount of winter roughage is provided for the lean months of the year. Mr. Skottowe supports this view when he observes: "If these [grasses] are mown before seeding their years of life are prolonged and the farmer receives a greater annual return of hay." Again, says our correspondent: "If it is cropped by stock sufficiently to prevent it seeding, it becomes patchy and gradually dies out." This, however, is probably due to over-stocking. The matter may be put this way, leaving out of consideration for the moment the grazing of stock: You wish to prevent the grasses from seeding; you may do

this either by burning or by mowing. The former method is a labour-saving one, and is rapidly performed, but it has the disadvantage of being detrimental to the veld in the long run. The latter method takes time and labour, but it possesses these advantages, namely, that it does not adversely affect the quality of the veld—in fact, in our opinion, it improves it—and that a quantity of feed is obtained for winter use. Introducing the factor of grazing, we observe that Mr. Skottowe's experience supports our view that cropping will prevent, or help to prevent, seeding, as well as help to obviate the necessity for burning. He says: "This past season, owing to the lateness of the first rains, my stock was kept grazing on the dry veld later than usual, and, in consequence, some of my paddocks were grazed too short to burn." At the same time, of course, the veld need not in normal times be cropped bare as Mr. Skottowe's paddocks were owing to the extraordinary season.

Following on the passage quoted above, Mr. Skottowe says that these grazed paddocks did not compare favourably with the paddocks that were burnt off, and that the young grass on the unburnt area was fully two weeks later in springing after the first showers of rain fell. Might we suggest, however, that the fewest blades of green grass will show up vividly against the otherwise unrelieved black background of a burnt field, whilst in the case of a recuperating cropped field the young shoots are not easily noticed against the greys and browns of the old grass. There is always that possibility to be considered, and it may have been the case with Mr. Skottowe's fields.

Coarsening of the Veld Grasses.

Our correspondent doubts whether, as we asserted in our April editorial, veld-burning "at the proper season" really does cause the coarsening of the various grasses of which the veld is composed, and he says that this has not been proved. Certainly we do not think this has ever been actually proved by experiment, but we must judge from analogy, and our reasoning in the matter simply amounts to this, that the annual severe shock of fire is more than the delicate economies of the finer grasses can stand; they tend to become killed out, leaving the strongest and coarsest to survive—indeed, only the very strongest, it is safe to presume, are likely to outlive the strain. Here is a question worth considering: Why has our veld—which, let it be remembered, has been burnt off year after year for a long period —such a low stock-carrying capacity that it is necessary to lay down special pastures of exotic grasses where we wish in the case, for example, of dairying, to obtain an equitable return on the capital value of the land? Partly, of course, we do this in order to obtain a single grass or selection of grasses of high feeding value; but must there not in the past have been in our veld some grasses of equally high feeding value, grasses that have gradually been diminished in number by this practice of veld-burning, whilst the stronger and less nutritious kinds have been able to dominate our veld on the principle of the survival of the fittest? And, had we not been obliged in the past by force of circumstances to burn our veld every year, would it have been so necessary now, except in areas of high-priced land, to consider the question of the laying down of "artificial" pastures?

Further, would not our veld have run more stock now to the morgen than it does? It is a question that has never been solved, and may be never will be solved, but it presents itself as a likely one, nevertheless.

The Point of View.

It seems to us that the whole question is capable of being summed up thus: Like every other country we have to make a bid for good farming, proceeding judiciously, carefully feeling our way, and bringing to bear all our forces to evolve the best method suitable for our conditions. And in this matter of veld-burning we have to ask ourselves this question: Giving full consideration to our local conditions, what is "good farming"? We think that, over large areas of the Union, the majority of properly established farmers (note that we quite leave out of consideration those who are beginning or are still fighting their way through the difficulties of the earlier stages of farming), were they to consider this question of veld-burning carefully in all its lights, would find that its abandonment would be consistent with—nay, evidence of—good farming; and when we speak of abandonment we do not necessarily mean the immediate and entire cessation of the practice, but its gradual displacement by a better system. Then there are others—in areas, for instance, where there is no sweet veld—who have alternative evils awaiting the abandonment of the annual firing of their grazing land. They may recognize that their present practice is not wholly unattended by eventual impoverishment of the veld, but until the other evils which its abandonment must bring into active operation can be otherwise counteracted, they must perforce continue it. They, too, must answer the question "What is good farming?" according to their local conditions, but they must recognize that "good farming" is but a relative term.

We welcome such criticism as "Natal Coast" and Mr. Skottowe have favoured us with, and we shall be pleased to have the views of others on this question. It is a subject that calls for the fullest discussion, especially in connection with cases such as those we have referred to in the previous paragraph where the lesser of two evils has to be tolerated. Some valuable evidence could be furnished by readers in this way and problems brought to light the existence of which is only locally known.

Finally, let us again remind readers that, as we said in our April issue, there are cases where this practice of veld-burning is necessary for the present. We are not advocating its being dropped entirely and at once, but what we do advise is that farmers should realize the evils of the system, even whilst they are obliged to continue its practice, and look ahead with a view eventually to discarding it in favour of more up-to-date methods. The pace of progress cannot be forced. In all spheres of human activity the progress of fifty years ago is the backwardness of to-day. Every step is necessary, and leads to further steps up the hill of improvement. And in connection with this question of veld-burning, too, we should not lose sight of the potent influence of settlement. It is the increasing value of the land, consequent upon increasing settlement, which will force us sooner or later to drop veld-burning as one of the necessary

practices of the extensive farmer of the old days of relatively cheap land.

There is a greater aspect of this question of veld-burning which we have not yet touched on, but the consideration of which we must leave to a subsequent issue, namely, the influence of the practice upon soil erosion. Most of our farmers realize the growing importance of this question, and it is very possible that our annual grass fires have some bearing upon the matter. We shall be glad to have the views of readers upon this interesting point, based upon observation, as some valuable light may thus be thrown on the problem.

The Raw Phosphate Question.

The question of utilizing raw rock phosphate for manurial purposes is of perennial interest to farmers living in areas within reasonable distance of natural sources of supply. In Natal some years ago supplies of crude phosphate were discovered in the vicinity of Weenen, and a syndicate was formed to exploit the material for farm use. Raw phosphate is supplied to farmers in a finely ground state, the idea being that, in this form, it will more readily become available as plant food. This rock phosphate is a natural fertilizer, in which the element phosphorus can be purchased by the farmer at a considerably lower figure than that which he has to pay for it in the form of superphosphate and other "high-grade" commercially prepared fertilizers. The difficulty that arises in connection with its use, however, lies in the fact that the phosphoric acid which it contains is in an insoluble condition, and requires the action of acids to render it available as a plant food. In the manufacture of superphosphate the raw phosphate is treated with sulphuric acid.

The question of the farm treatment of raw phosphate has been the subject of much investigation at various experiment stations in the United States, and a discussion of recent results by Cyril G. Hopkins, of the University of Illinois, is published in a late issue of *Hoard's Dairyman*. It appears that all the long-continued field experiments agree in showing that raw phosphate is by far the most profitable and economical form of phosphorus to use in rational systems of general farming; but they also show that the most satisfactory results are secured when conditions are provided under which the phosphorus is made available; and the best condition in which to use the raw phosphate is to apply it in intimate connection with decaying organic manures, such as farm manure and green manures. In experiments in this connection at the Rhode Island Station, raw phosphate was mixed with fresh cow-dung, and the mixture allowed to stand in closed bottles or loosely covered pans in a dark cellar for about nine months. At the end of this time it was found that, while the availability of the phosphorus was not markedly greater than when first mixed with the dung, the raw phosphorus increased by 30 per cent. the effect of the "pan" dung as compared with the increase in yield when dung alone was used. The "bottle" dung gave poorer results than that which had been exposed to the action of the air in the pans, but in both cases the average results show distinctly increased yields due to the raw phosphate.

More extensive investigations at the Wisconsin Station support the results of other investigators in showing an appreciable decrease in the solubility of phosphorus during the early stages of fermentation, both of manure alone and of manure and phosphate mixtures, not only with raw phosphate, but with superphosphate also, owing to temporary use of phosphorus as food for bacteria; but the Wisconsin investigators also show that the decrease reaches a minimum, after which increase in solubility occurs, although the maximum increase has not yet been determined. The conclusion is drawn by them that, "so far as pot experiments indicate conditions in field practice, the final results from mixing rock phosphate with fermenting manure appear to be advantageous."

Striking Experimental Results.

The most positive and conclusive information, however, is yielded by experiments conducted at the Ohio Station during the past sixteen years. As an average of all crops harvested, the yields have been practically the same whether the phosphorus was applied in raw phosphate or superphosphate costing twice as much money, although supplying only half so much phosphorus. Some striking figures, too, are given in a recent bulletin from the same station, in which it is reported that the ploughed soil of an acre of two million pounds weight contains on an average 6 lb. of available phosphorus (soluble in weak nitric acid) where the land has not been fertilized, 5.8 lb. where "complete" fertilizers have been used, 8.9 lb. where manure alone has been applied, 11.7 lb. where manure and superphosphate have been added, and 36.1 lb. where the fine ground raw rock phosphate has been applied in connection with the manure. These results, as Professor Hopkins points out, plainly reveal both the availability and the cumulative effect of raw phosphate used in rational systems and in larger amounts than are required for crops removed.

We may fitly conclude with the following suggestive quotation from the *Hoard's Dairyman* article before us:—"When we consider," Professor Hopkins observes, "that the air above each acre of land contains 70,000,000 pounds of nitrogen, and that normal cornbelt soil contains as an average about 1200 pounds of phosphorus and 35,000 pounds of potassium in the ploughed soil of an acre of 2,000,000 pounds weight, then we should expect substantial increase from the system of farming practised by the Ohio Station, in which clover is used to secure nitrogen from the air and organic manures are ploughed under to liberate both potassium from the soil and phosphorus from the raw phosphate applied with the manure. This, with the addition of limestone as needed, provides a truly permanent and profitable system of soil improvement; and the results secured are in striking contrast to those reported in a recent valuable bulletin (No. 155) of the Indiana Experiment Station, showing that, as an average of seventy-three different tests in many countries, the value of the increase in crops of corn [maize], oats, wheat, hay, and potatoes was only $1.13 [4s. 8d.] for every dollar [4s. 2d.] invested in "complete" commercial fertilizers when applied to the common loam and clay soils of that State."

Effect of Grass on Fruit Trees.

The question of the action of grass on fruit trees has been the subject of much investigation at experiment stations in various parts of the world, and notably at the famous Woburn Experimental Fruit Farm in England. The action of grass on fruit trees is often so deleterious that it arrests all growth, and even causes the death of the tree. The action is not noticed so much when the trees become grassed over gradually during the course of several years, for in these surroundings they can apparently adapt themselves to the altering conditions and suffer much less than when the grass is actually sown over their roots. In a note in the *Barbados Agricultural News* on the recently issued Thirteenth Report of the Woburn Farm, which contains an account of classical research on this subject, it is mentioned that it was thought some years ago that the action of the grass might be explained by its affecting the aeration of the soil by altering the amount of carbon dioxide present, or by its effect on soil temperature, the moisture content, or mechanical conditions. Any explanation on such grounds was found to be inadequate. Various ingenious experiments were conducted in order to obtain this negative generalization. The biological investigation of the question was then proceeded with, commencing with an examination of the effect on fruit trees by heating soils—partial sterilization. It was discovered that a toxic substance is produced by heating soils, which was found to be toxic towards the germination of seeds as well as towards the growth of plants, retarding the germination and reducing the percentage of seeds which germinate. After cultivation, however, the toxic substances become oxidized and the soil supports growth better than when not heated. Curiously enough, soil removed from grassed ground was slightly more favourable towards germination than the tilled soil, and it absorbed water much less readily than the neighbouring tilled soil. This behaviour provided negative evidence in favour of the production of toxic substances in grassed soils, and strong evidence of a positive character was obtained later by causing washings from grass growing in soil on trays to reach tree roots with practically no exposure to the air. A deleterious effect was then produced nearly if not quite as great as when the grass was grown above the roots in the ordinary way.

Oklahoma Maize Contest.

Last month we referred to the value of maize contests, and quoted the recent Minnesota competition as an example. We have since come across a note on the last Government acre-contest conducted in the State of Oklahoma, in which the winner, Elston Coleman, 13 years of age, describes the method he followed in raising crop. Coleman's yield was 101 bushels 9 lb., or about 33 muids. He leased an acre of ground from his father—a rich, black, sandy loam that had been under lucerne for six years—and searched until he found what he considered to be the best variety of seed for his land, viz., Johnson County White, for which he paid at the rate of 16s. 8d. per bushel. Seed maize could have been purchased at 4s. 2d. per bushel, but he wanted the best, and as a result he not only won the free trip to Washington

and to the maize show at Columbia, S.C., but he has sold his entire crop for 12s. 6d. per bushel, while ordinary maize has been selling at 2s. 1d. per bushel. His account of how he raised his crop is well worth reading. He says: "On 3rd April my father helped me to plough the ground seven inches deep, after the alfalfa [lucerne] had made quite a growth. After ploughing, and up to the time of planting, I harrowed the ground four times lengthways and crossways, with the teeth of the harrow set almost straight, and I rode on the harrow. I planted on 24th April, using a lister to make the furrows, which were 5 inches deep and 3 feet apart. I used a one-horse drill, dropping the kernels 14 inches apart, and pressing the dirt firmly over the corn. The seed-bed was in fine condition, as we had plenty of rains to pack the ground. In cultivating I used mostly the harrow and five-tooth cultivator. After I had been over my corn three times with the harrow, and one time with the float, I used the two-horse cultivator once, which left the ground almost level. I then cultivated with a one-horse five-tooth cultivator, going over my acre eight times with the five-tooth cultivator, generally after rains, and as often as I thought necessary, making thirteen times I cultivated my acre. I would have cultivated it more, but a heavy wind blew some of the corn down. The ground, however, did not pack and become hard, but remained loose during the remainder of the season owing to the many alfalfa roots. My corn grew rank and tall. It was surrounded on three sides by heavy timber, and on the south side by a high bluff covered with timber, which helped to protect the corn from the hot south winds. My father and a witness helped me to gather my corn, as it was so high I could only reach the low ears and look for those they might pass. We gathered it on 3rd October, and weighed it on 7th October. There were 92 bushels and 29 pounds of ear corn. The percentage of shelled corn was 87½, making 101 bushels of shell corn, for which I received $303 [£63. 2s. 6d.]." Coleman's report as to his expenses and receipts filled out on the Government report card is as follows:—Expenses for rent of land, preparation of seed-bed, seed, planting, cultivation, and gathering, $14.75 [£3. 1s. 5d.]; receipts from 101 bushels, $303 [£63. 2s. 6d.]; less expense, $14.75; actual profit, $288.25 [£60. 1s.].

Hagenbeck's Ostrich Farm.

From time to time reports reach South Africa of attempts which are being made in other countries to establish an ostrich industry, but nothing like serious progress is being made, if the accounts that come to hand can be relied upon. In the United States the industry has been established on a small scale, but there appears to be little for South Africa to fear in the way of competition. Some of the birds used as the basis of new ventures are obtained from Northern Africa, whilst a number are supplied from the ostrich farm at Stellingen, in Germany, started by Mr. Carl Hagenbeck, whose death was announced a short time back, and who was also the owner of the famous Zoological Gardens at Hamburg. A correspondent has sent us a copy of a letter he has received from the manager of this farm, which contains some interesting details of the operations of the institution. The farm was opened on the 21st June, 1909, by Her Majesty the Empress

of Germany, and since that date on an average twenty-five strong, healthy chicks have been raised every year. In summer there are always between 100 and 150 ostriches on the farm, and orders are booked for autumn delivery, at which season there are few visitors, and consequently the same number of birds are not needed for show purposes as are required at other times of the year. The ostriches are housed only in winter, at night, in an unheated stall. They are said to stand the cold very well, but so many birds are housed in a comparatively small barn that it is found that during the winter months the feathers get somewhat broken up. The quality of the feathers is reported to be very good, and much better than the specimens the manager has seen from German East Africa, but, owing to the winter housing, the South African feathers are more even. The breeding birds are enclosed in pens 45 by 75 feet, and are hand-fed. There is also one fairly large paddock, where from 75 to 100 birds run together. These, too, are hand-fed. The chicks are hatched by incubator, and, provided they are properly looked after, little difficulty is experienced in raising them. A special house is provided for this purpose, and lucerne is grown for them to feed upon during the first six weeks. The manager observes: "Up to the present I have not sold any birds under one year old, and consider that full-grown birds are by far more advantageous for prospective farmers, as they can expect eggs from them the first year, and, if not the first year, surely the second; but by buying young birds one will have to keep them at least three years before they start breeding." He adds: "I am expecting a big shipment of ostriches from Africa in the month of April."

The Month and the Magazines.

An investigation into the purchasing power of agricultural produce in the United States up to 1911 has been carried out by the Bureau of Statistics, and some of the principal results are noticed in the *Crop Reporter* issued by the Bureau. It appears that the purchasing power of the products per acre was greatest in 1909, although the total value was greater in 1910 and 1911, in consequence of an increase in the acreage of crops. In 1909 the money value of an acre of crops averaged 72.7 per cent. more than in 1899, while the average value of articles which the farmer buys is put at 12.1 per cent. higher. The net increase in the purchasing power of the produce of one acre is estimated at 54 per cent. Results in 1912 have not yet been brought into comparison.

A writer in the *California Cultivator* says that to-day private agricultural experimentation is rapidly approaching the dignity of a profession, the greatest drawback to a more rapid advance, indeed, being the lack of men capable of doing this kind of work—men fitted by disposition, proper training, and practical experience to take hold and push the work to a successful conclusion.

In the *Breeder's Gazette* Roscoe Wood writes on the subject of "Honesty in putting up Wool." He observes that in any trading in wool much must depend on the honesty of the trader, and that naturally in the first instance it depends upon the grower, on whom must eventually rest any burden of misrepresentation which may be

due to the impossibility of the buyer being able to see and determine for himself. Few buyers can see every fleece in a clip of any size, and none see the inside of those fleeces. Dependence must be placed upon the grower that he has put nothing but clean, dry wool inside that fleece. If that fleece or clip proves otherwise when it reaches the sorting table at the mill, then the place from which it came is carefully noted and remembered, and any wools coming from there in the future must bear the burden of the dishonesty or carelessness of some one or a few men. "Realizing the importance of thus putting up the fleece so that it holds nothing but clean wool," says Mr. Wood, "care must be taken that sweat-locks, dung-balls, and other filth which may be on the trimmings are sent to the manure pile instead of the wool-bin, for good fertilizer belongs to the land, not in a woollen bin."

According to the *Board of Trade Labour Gazette*, at the end of the year 1911 there were in the British Isles 768 separately registered societies engaged in agricultural distribution and production, with an aggregate membership of 94,884, and a total capital of £748,561. Their aggregate sales during the year amounted to £4,526,884, upon which a profit of £62,373 was made. In addition, there were 72 industrial societies and one agricultural distributive society which had departments engaged in farming and dairying operations. The total value of the produce of these departments amounted to £330,267.

The value of the "demonstration train" is referred to in an article in *Hoard's Dairyman*, where reference is also made to a dairy car which has been specially built by the Southern Railway Company of the United States, and fitted in consultation with the dairy experts of the National Department of Agriculture. At one end of the car are placed the dairy appliances; the rest of the space is devoted to seats for the people attending lectures and demonstrations. Around the walls are placards carrying practical advice or information for the farmer. Trained men are in charge to give lectures and distribute educational literature. This car started on its journey in March, 1912, and has been constantly employed since that time, with the exception of a very few days. It usually stays a day at a town, and frequently the demonstrators hold meetings from early in the morning until nightfall. The car is worked on a regular itinerary, the schedule of stops being prepared a month or six weeks in advance. Each meeting is announced in the county papers and by poster, and post-card invitations are sent to all the farmers of the neighbourhood whose addresses are known. It is estimated that so far not less than 18,000 people have visited the car, listened to the lectures, and witnessed the demonstrations. Among the practical results accomplished have been the building of silos, the purchase of a better grade or breed of cows, by many the purchase of pure-bred bulls, the improvement on many farms of methods of handling milk and of making butter. One instance is recalled where a woman who was making a poor grade of butter changed her methods after a visit to the car, and increased her selling price from 15 to 30 cents a pound.

The *Agricultural News* (Barbados) mentions the existence in the Belgian Congo of a very contagious disease known as thrush (*la teigne*), which causes very considerable loss among poultry in that

country. The disease is due to a fungus parasite of the same family as *Trichophypton tonsurans*. The first symptoms are white spots on the comb and ears. These spots rapidly extend and finally unite to form large patches of yellowish-white scurf over the entire head. The bird loses its senses of sight and hearing, and then quickly succumbs. A solution of perchloride of iron, mixed with two to three times its weight of glycerine, is used to treat the diseased parts.

The *Agricultural Gazette* (London) records the coming dispersal of the old-established and celebrated Babraham flock of Southdown sheep, including all the noted prize-winning animals. Mr. Adeane founded this flock nearly thirty years ago, and the majority of the pedigrees go back to sires bred by Mr. Henry and Mr. Jonas Webb. The remarkable success of this flock in the showyards and its uniformity of type is largely due to the use of this blood.

Discussing the question of sorghum poisoning, a writer in the *Breeder's Gazette* ascribes the formation of hydrocyanic acid to the prevalence of drought conditions without frost. He adds that the acid disappears very soon after the sorghum is cut, breaking down into other compounds.

The Wattle Bagworm

(*Chalioides junodi* Heylaerts).

By CLAUDE FULLER, F.E.S., Division of Entomology.

PREFACE.

THE Bagworm, herein alluded to as "The Wattle Bagworm" (*Chalioides junodi* Heylaerts), is an insect native to South Africa. Its natural food plants are several thorns (acacias) common to the region it inhabits. It is naturally very widespread and not uncommon in the Provinces of the Cape, Transvaal, and Natal.

As a potential pest to wattle culture in Natal, attention was first drawn to it by the Cape Entomologist (C. P. Lounsbury) in the *Cape Agricultural Journal*, February, 1899. Further to this the insect is the subject of several notes by the Natal Entomologist (C. Fuller). Some account of its life-history is given by Fuller in his first report (1899-1900), and it is there mentioned as a pest of more or less importance in nearly every wattle plantation in Natal.

Subsequent to 1900 the culture of the wattle (*Acacia mollissima*) extended very rapidly. In 1884 the value of the bark exported was only £11; in 1896 it was £17,000; and in 1910 the value was set down at £200,000. As late as 1908 the area under wattles was only 30,000 acres, but it was estimated that with the close of 1912 something approaching 300,000 acres would be devoted to bark production.

Writing in 1909, the Natal Entomologist remarks, *inter alia*, "as a pest it is no worse to-day than it was twelve years ago and, if it does occasionally assume alarming proportions, it never becomes absolutely ruinous." The insect, however, became very widespread, and proved extremely injurious in the New Hanover District of Natal in the summers of 1911 and 1912, and this conspicuous outbreak throughout a thickly planted area at once gave rise to grave apprehension.

Acting under instructions, the Natal Entomologist then began, in connection with his routine work, further observations upon the pest, which were continued until the close of 1912. These observations are elaborated in the present article. It was, however, contended by that officer that further progress in the study and control of the pest could not be expected unless a special investigation was undertaken. This special investigation is now in progress and is in charge of Mr. C. B. Hardenberg, of the Division of Entomology, with headquarters at New Hanover.

In this discussion of the subject the opinion is premised that the recent severe infestations are largely due to physiological factors, and an endeavour made to show that the physical and climatic factors of Natal not only have a considerable influence upon the ascendency or otherwise of this insect but also restrict its range as a pest. In other words, that in districts with the physical conditions pertaining to that of New Hanover, where wattles are abundant, outbreaks of Bagworm, accompanied by severe injury, will occur under certain climatic conditions. In this connection the opinion of practical wattle growers are brought forward to support the theory.

It is pointed out that the introduction of Australian wattles to Natal, coupled with their extensive culture, has given the Bagworm many opportunities of extending its range. Its adaptability to new environments and hosts is illustrated by the facts that it is now to be found from near sea-level to altitudes of 5000 feet, and that it subsists readily upon guava, rose, blackberry, oak, and apple as well as upon the Australian acacias.

The effect of defoliation by Bagworm is likened to that of a particularly dry season, the bark increment being checked to varying degrees. It is pointed out that this loss may be of considerable moment in the case of a dry autumn, whilst even an excessive defoliation would be of much less consequence if the autumnal rains are good. The evidence of wattle growers is given to show the variability and uncertainty as to the amount of loss sustained by defoliation, and that no plantation is ever so severely injured that it will not pay to harvest.

The impracticability of eradicating the insect from South Africa is accepted. In reviewing the monetary loss in relation to the actual cost of control measures involving the destruction of the insects by poison insecticides, it is shown that the cost appears prohibitive. There are a number of measures that can be taken to mitigate the abundance and spread of Bagworm, but these are largely discounted, being to a large extent impracticable of adoption by wattle growers.

The Bagworm is able to increase and multiply at a prodigious rate, but this is set off by many natural checks. There are difficulties attendant upon mating, large numbers of young are destroyed by spiders and insects and lost before even making a bag, many being carried afield by wind. Throughout the larval life the insect is assailed by many troubles, some doubtless diarrhœtic, by fungus

parasites, by fly parasites, and wasp parasites; and, further, it is preyed upon by birds and by the white-nosed rat (*Mus concha*, A. Smith).

Excessive damage to plantations arises from gross-infestations. This form of attack upon juvenile plantations, whilst a striking feature of the last two seasons, is unusual; gross-infestations in the ordinary course of events do not arise until after the fourth year of growth.

The gross-infestation of young plantations is ascribed to the greater opportunity for spread arising from extended plantations and to the carriage of the young larvae through the air by berg winds, the young being apparently capable of such transportation in a similar manner to ballooning spiders.

The article which follows was prepared in December, 1912, but had been unavoidably held over from publication owing to various circumstances.

With regard to the theory advanced that the white-nosed rat (*Mus concha*) is responsible for the destruction of large numbers of Bagworms, it is of interest to state here that the matter has been since investigated by Dr. Ernest Warren, D.Sc., Director of the Natal Government Museum, who as the outcome of his observations upon the habits of these rodents writes to Mr. Fuller as follows:—

"Allow me to congratulate you on your idea that the so-called white-nosed rat is of economic value in destroying Bagworms.

"Living Bagworms have been given to the rats received from the Clan Syndicate, and they tear open the tough bags and greedily devour the caterpillar. The torn bags in every way resemble those found in the field which you showed to me."

The addendum, "Unscientific Notes on the Bagworm," by Miss Pegler, originally appeared in *Grocott's Penny Mail*, Grahamstown, 1st December, 1909.

INTRODUCTION.

For some time past an endeavour has been made to ascertain the true status of the Wattle Bagworm (*Chalioides junodi* Heylaerts) in relation to the methods of wattle-bark culture as evolved and practised in Natal; and the purpose of these notes, or series of notes, is mainly to place upon record the conclusions the writer has been enabled to arrive at with the somewhat limited opportunities at his command.

The outcome of this work has been to reveal the absolute necessity for some special and uninterrupted investigation of both this pest and other insect pests of the wattle tree (*Acacia mollissima*) before any economic solutions of the problems presented can be reasonably put forward. To this end my work has served its purpose; and with the advent of the year 1913 an entomological station was established at New Hanover in Natal, where it is proposed to fully investigate the life-histories and the habits of various wattle pests, and to experiment along any lines promising practical treatments for their suppression or control.

As I review in my mind much that I wish to set down I cannot truthfully say that it will serve any immediate utilitarian purpose. "To the terrible utilitarian a bushel of peas preserved from the weevil is of more importance than a volume of observations bringing no

immediate profit," says Fabre; and, because this endeavour of mine bids fair to become but a collection of observations and ideas, I may perchance be forgiven for quoting even further from the writings of the delightful French naturalist that lie before me. "Yet who has not told you, O man of little faith," he continues, "that what is useless to-day will not be useful to-morrow. If we learn the customs of insects or animals we shall understand better how to protect our goods. . . . It is by the accumulation of ideas, whether immediately practical or otherwise, that humanity has done, and will continue to do, better to-day than yesterday, and better to-morrow than to-day. If we live upon peas and beans, which we dispute with the weevil, we live also by knowledge, that mighty kneading trough in which the bread progress is mixed and leavened."

Speaking in a general way, ten to thirteen years ago the Wattle Bagworm was more an interesting than an important insect pest. True enough, it had shown potentialities for mischief by occasional exhibitions of conspicuous damage; but, despite its threatening aspect, it maintained until lately this comparatively innocuous phase. To-day it is the subject of more general complaint, being of late years excessively abundant in certain, but restricted, areas. Because of this and, further, because so many more farmers have taken up wattle culture and many others are interested in the industry by virtue of invested capital, a great deal more notice is taken of the Wattle Bagworm, a pest which older growers have accustomed themselves to regard as a concomitant, and to classify among their business risks; or, in the words of one of the oldest, to have "sufficient of the gambler's spirit to let the plantations take their chance."

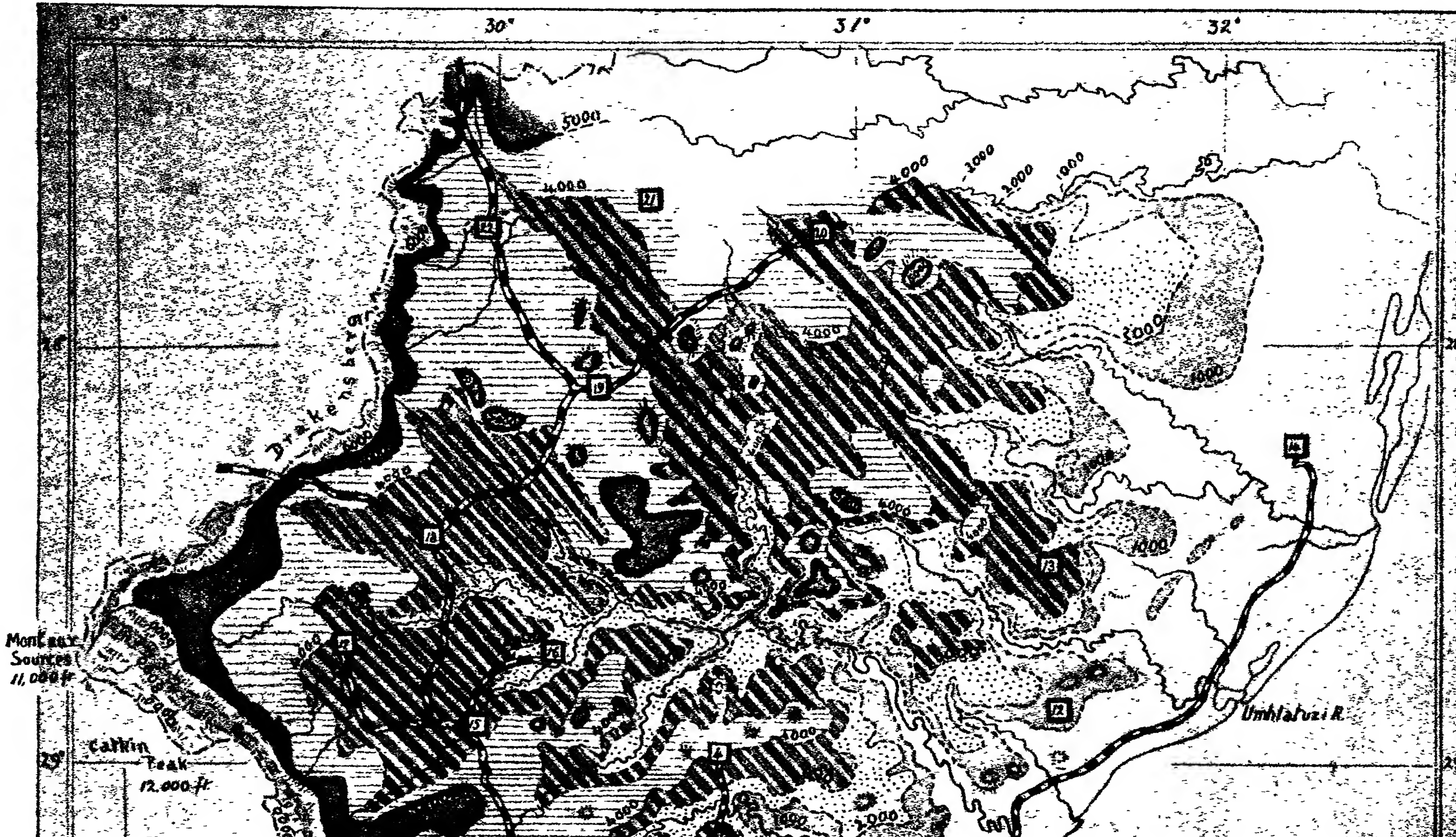
The last few seasons, certainly the springs of 1911 and 1912, saw many phenomenal and gross-infestations of quite young plantations, especially in the District of New Hanover. It is these that have given rise to much of the grave apprehension which now exists. To sum the matter up shortly, it is thought by a section of growers that the insect is at length gathering force in that district and threatening to become a distinct menace to the industry throughout the country.

How far the future may show this fear to be well grounded it is impossible to say; but, serious though the matter may be, and calling as it does for immediate attention, I cannot accept that pessimistic view.

THE WATTLE INDUSTRY.

The fathers of the wattle industry are those two esteemed colonists, Sir George Sutton and the Honourable F. T. Angus, to whom the writer owes so much for their encouragement and goodwill over many years. The rise of the industry, which dates only from 1884, has been remarkable. In 1886 the value of the first lot of bark exported was but £11. For the following three years the figures were £315, £410, and £2700. By 1896 the value had increased to over £17,000, and in 1910 the free on board value was returned at £200,000.

In 1908 the estimated area under wattles was set down at 30,000 acres. The prophecy was then made that this would be doubled or trebled in four years' time. This prediction actually came about; and, whilst it is not possible to ascertain the acreage that was under wattles in Natal at the close of 1912, it cannot fall far short of 300,000 acres.



30°
31°
32°
Drakensberg
Mont aux Sources 11,000 ft
Cathkin Peak 12,000 ft
Umhlatuzi R.

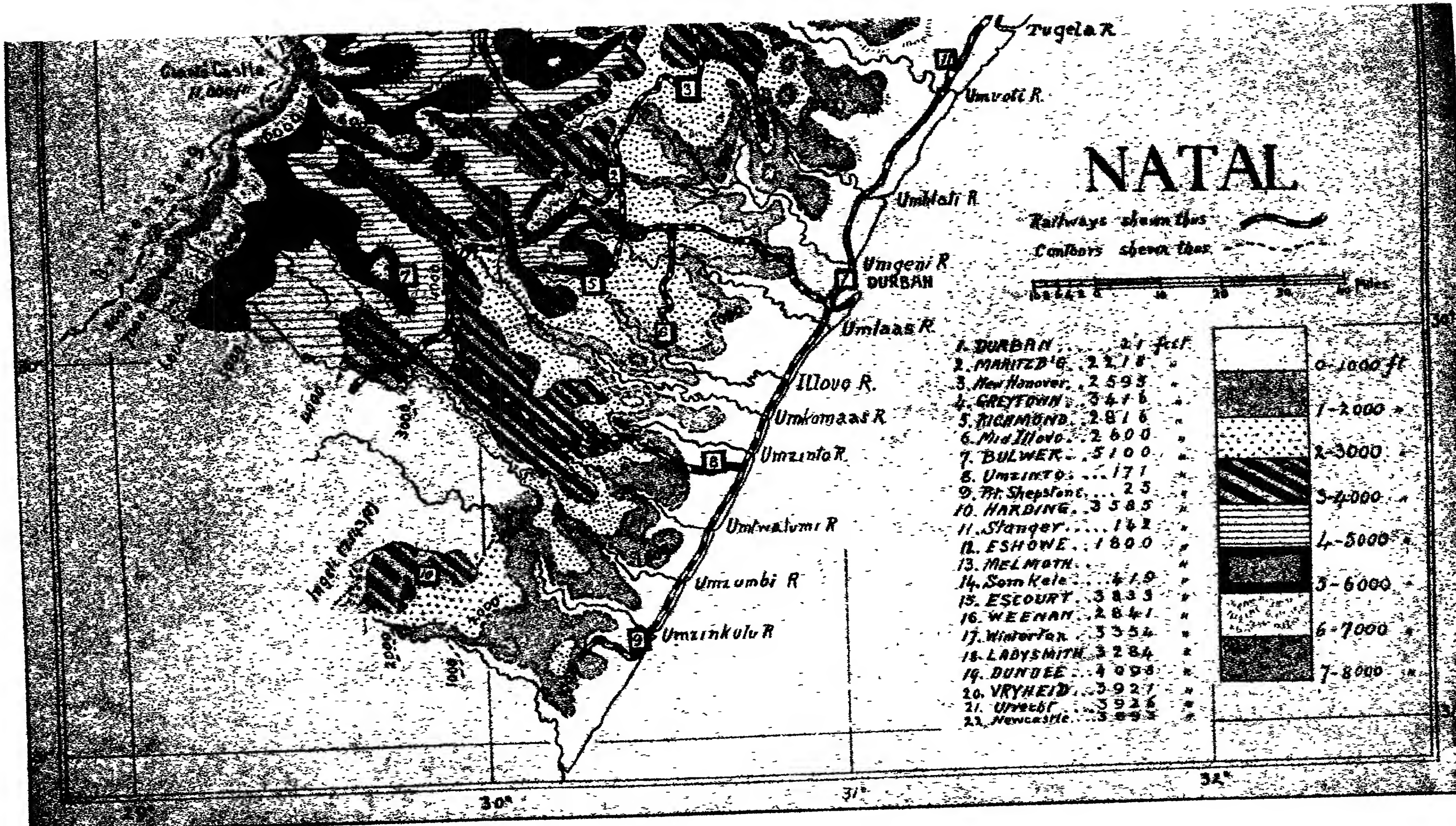


Plate No. LXVI.

This rapid growth of the bark industry has involved the planting of trees in the many soils and subject to that variety of climates which the Province of Natal (despite its small area) affords. From such a state of affairs it is more than likely that a variety of complex problems will arise, not alone as regards insect and fungus troubles but others of physiological nature.

Because the wattle tree (*Acacia mollissima*) has flourished in the districts where it was first established, it would appear that the same beneficial results were expected from the whole of the country. But this can hardly be so, and it may be safely said that Natalians are not only expecting too much of Natal, but also too much of their Australian friend, the wattle.

What is most extraordinary to the onlooker at this considerable enterprise, now so well under weigh, is that no real attention has been given the many problems surrounding the production of tannic-acid producing bark. All know that the acid contents of barks vary, and all know that the bark-producing capacity of different soils are very different; still there is no reliable data obtainable on any hand. It is equally well known that the very trees display individuality, and yet an effort to improve by seed selection seems not to have fascinated a single wattle grower. Among the trees of most plantations also are to be found here and there a distinct strain known as *Acacia nomalis*. Many agree that its virtues are at least equal to its predominating partner, but it is extremely doubtful whether a pure plantation exists anywhere. In short, the "science" of wattle growing is an unexplored field, however excellent, and they are excellent, practical methods have become.

THE PHYSICAL AND CLIMATIC FEATURES OF NATAL.

The physical irregularities of Natal, apart from attendant soil irregularities, have a remarkable effect upon the flora and insect fauna of the country; because of them we have widely different yet permanent climatic conditions occurring in nearly associated areas. If to these are added the vagaries of climate as from year to year, it is frequently possible to explain many phenomena of insect life which otherwise seem quite extraordinary.

It is part of my endeavour to show that the potency of the Bagworm is ordinarily restricted to a narrow zone of country, and that this belt is widened or narrowed down in accordance with what are considered good and bad seasons.

To do this sufficiently it is necessary to cover a good deal of ground that ordinarily does not find a place in entomological literature.

In order to give point to the effect of natural conditions I may say that I have frequently heard farmers (from different parts of the country) discussing the behaviour of a certain insect according to their personal experience. Not infrequently they have been discussing under one popular caption two distinct creatures, one taking the place of another under a different set of climatic conditions, but in closely associated districts—perhaps even one and the same district so far as the artificial boundaries of, say, a magisterial division are concerned.

According to an official handbook "the physical geography of Natal is not difficult of description," and true to his idea the writer disposes of his subject in a few clean-cut sentences. He tells us

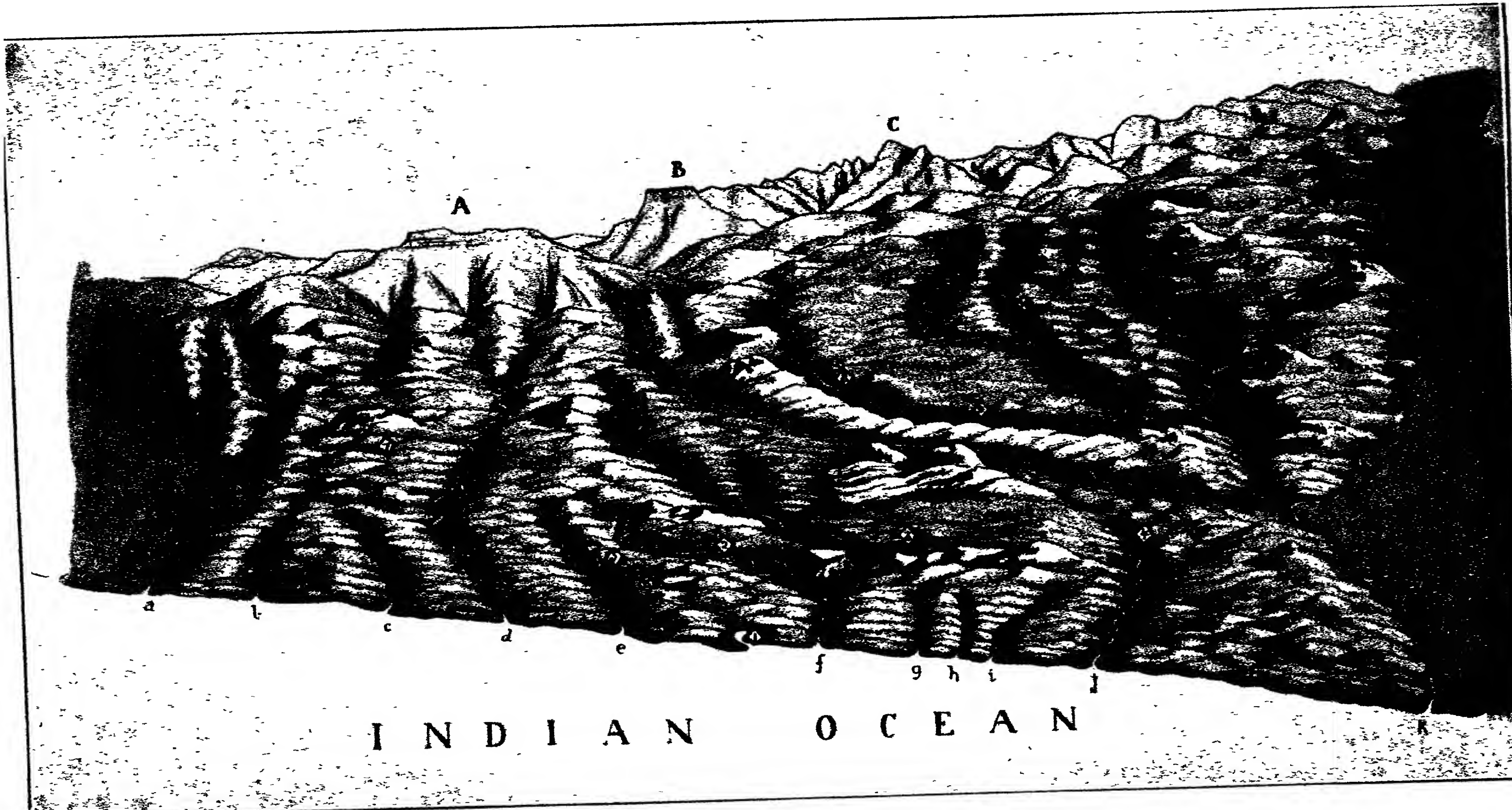


Plate No. LXVII.

SKETCH MAP OF NATAL.

Mountain Peaks: A, Giant's Castle; B. Cathkin Peak; C Mont aux Sources
Towns: (1) Durban; (2) Pietermaritzburg; (3) New Hanover; (4) Greytown; (5) Richmond; (6) Mid-Illovo; (7) Bulwer; (8) Estcourt; (9) Weenen; (10) Ladysmith.
Rivers: (a) Umzimkulu; (b) Umzumbi; (c) Umtwaluni; (d) Umkomaas; (e) Illovo; (f) Umgeni; (g) Umhloti; (h) Tongaat; (i) Umhlali; (j) Umvoti; (k) Tugela.

that "starting from the coast the country, by a series of almost regular steppes attains an altitude of two and a quarter miles. . . . The first steppe from the sea extends about fourteen miles inland and attains an elevation of about 1000 feet. The second starting from this point is about twenty miles broad, which brings us, at a distance of thirty-four miles from the sea, to an altitude of 2000 feet. The third terrace, about twenty-five miles in breadth, sweeps to an altitude of 3700 feet. The fourth, of almost equal breadth, is about 5000 feet. The fifth, and last, soars to 6000 feet." Unfortunately one cannot dispose of the subject quite so easily. True enough the country rises most rapidly from sea to mountain top with scarce a level area anywhere—certainly never a plain. Steps or terraces, perchance, to the "Roof of Africa," but not "steppes"; and then with many a mighty obstacle.

The average land elevations are shown in Plate LXVI, (1) and in Plate LXVII the writer has essayed to give a more or less pictorial representation of the Province. Fig. 1 (2) shows a section of the country from Giant's Castle to the coast near Verulam.

It is the irregular features of the country that provide the bleak highlands where, in winter, plants and animals struggle with cold and frost, whilst hard by, in some sheltered kloof, almost tropical vegetation may hold its own. They give us our dry sunburnt river valleys (thornveld) where the native acacias, the aloes, and euphorbias flourish. They provide the moist slopes to which the native forests cling, the hail belts, the mist belts, and the rain belts, and they frequently decide whether this insect or that shall assume pestiferous proportions or not.

Mist and Rain.

Mist and rain are but two illustrations of the deposition of water upon the earth. If moisture-laden air comes in contact with any cold surface some of the moisture is deposited. Both mist and rain are due to moisture-laden air. It naturally follows that an abundance of mist will coincide with what we call a good season, and in a dry season mists will be scarcer, or at any rate much restricted and of less frequency and intensity.

Figure 2 is a section of Natal from the Mooi River heights to the sea, passing down from Highlands through Hilton and Hillcrest to Durban, and the arrow-headed lines represent the moisture-laden atmosphere travelling inland from the sea. Hillcrest, Hilton, and Highlands are well known points within what are regarded as the three conspicuous mist zones of Natal, and it will be seen that it is because of their peculiar prominence that they condense the mist out of the moisture-laden air. Equally also do intermediate prominences condense their share of moisture, and from the diagram it is seen why some farms or parts of farms are misty, whilst near by none is experienced.

Climate.

Speaking more generally of the climate of Natal we may say that the Province enjoys a wet summer and a dry winter. To be more exact, three-quarters of the annual rainfall occurs between October

(1) Designed from a map recently prepared by Mr. A. Hammar, Government Surveyor, Natal.

(2) From a diagram by David Draper, F.R.G.S.

and March, whilst June and July are practically rainless months. On the coast the temperature seldom falls below freezing point, frosts are rare, and there is much less variation in the temperature throughout the year. As one ascends the more does the temperature vary, and the sudden falls of temperature that are experienced become the most striking feature of the climate; indeed in the winter months a difference of 50° F. in twenty-four hours may not be uncommon. In

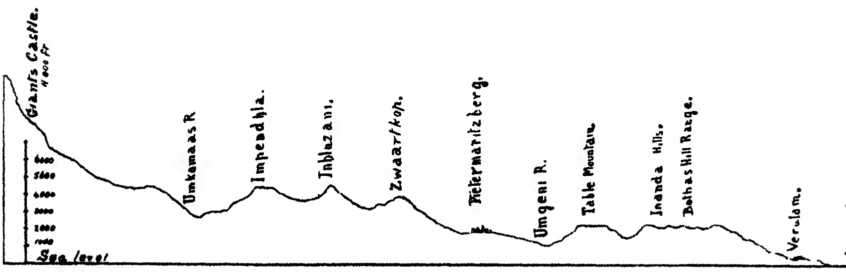


Fig. 1. Section of Natal from Giant's Castle to the sea near Verulam.

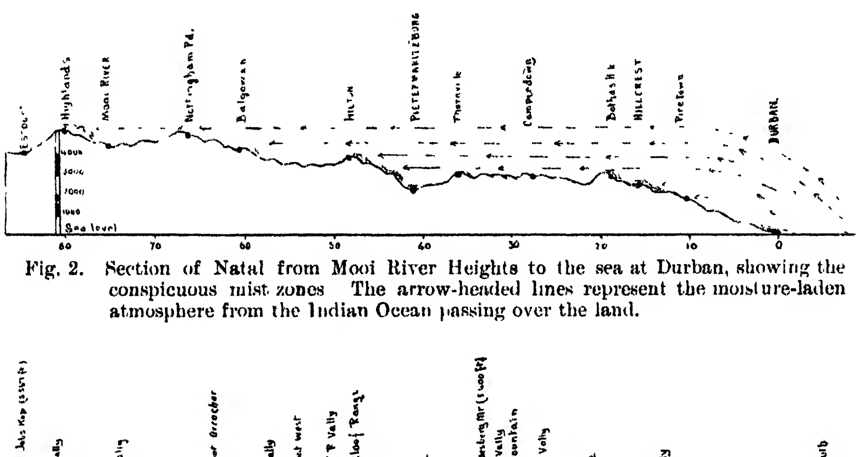


Fig. 2. Section of Natal from Mooi River Heights to the sea at Durban, showing the conspicuous mist zones The arrow-headed lines represent the moisture-laden atmosphere from the Indian Ocean passing over the land.

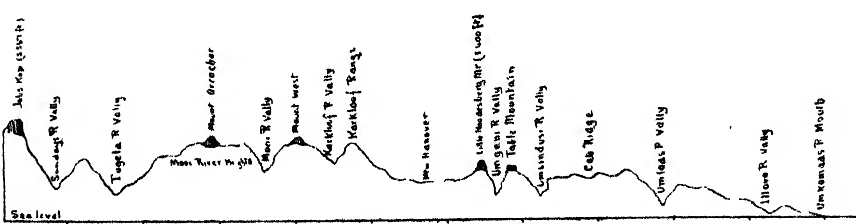


Fig. 3. Section of Natal from Umkomaas River Mouth to Job's Kop Mountain, as traversed by the wet S.E. winds; illustrating how the high ridges intercept the clouds.

fact winter may change almost to summer if for a short period warm nights be experienced. It is this factor which accounts for false springs in certain instances and for a concomitant early emergence of hibernating insects. Further, it equally accounts for late frosts with their natural concomitant the destruction of animal and vegetable life.

The summer rainfall of Natal is dependent upon the south-easterly winds of the Indian Ocean. It is these winds which come bearing rain clouds and saturated with moisture towards, and carry

on over, the land. As soon as they come in contact with the cool earth they deposit rain, and it is for this reason that the coast has its high rainfall. Then as each terrace or step in elevation is passed over rain or mist is again deposited and places along the edges or land prominences receive the higher rainfall. The clouds pass over the deeper valleys and, depositing no mist, less moisture reaches them. Figure 3 shows a section of the country as traversed by the moist winds and illustrates how the high ridges intercept the clouds.

Owing to the proximity of the moisture-laden atmosphere of the sea the atmosphere of the coast is always humid and the rainfall more continuous, showers being experienced even during the driest of the winter months.

THE BAGWORM ZONE.

The Bagworm (*Chalioides junodi* Hey.) (3) is a native of Africa, and as such is widely distributed. Its actual range I am unable to speak to, but it is known to me to also occur in the Cape Province and in the Transvaal. Its native foodplant or host is the thorn tree (*Acacia horrida*). Its exact range of native foodplants has not been worked out, but I have never taken it except upon three species of thorn trees. Its actual distribution throughout the sub-continent may reasonably be expected to coincide with the range of its host plants, which is a fairly wide one. Its natural range in Natal prior to the planting of the wattle (4) was necessarily restricted to that of its foodplant. In other words, it extended from the coast to the limits of the thorn veld. Nowadays it is to be found upon the cultivated acacia to an elevation of 5000 feet (Highlands). It may occur upon wattle at a higher elevation, but in the absence of exact data it is impossible to make such a statement.

For some considerable period wattles (*Acacia mollissima* and *A. dealbata*) have been grown in the midlands (2000 to 4000 feet), consequently the Bagworm has had sufficient opportunity to display its adaptability to many new environments. More latterly wattle culture has been carried down to the coast, at some points to within almost a few yards of the sea (Winkle Spruit).

It has not been possible for me to make as full a study of the insect, under what I would term its native conditions, as I should have liked. This would involve a very extended survey of our thorn and coast bush veld. Moreover, the insect is by no means an abundant one amongst its native surroundings, and is not frequently to be met with. Upon rare occasions fairly well infested thorn trees (sometimes an individual tree, sometimes a few trees growing near together) have been found, but in these cases it seldom happens that the infestation is at all permanent. Furthermore, these being far afield from the ordinary yearly round of duties no continuous observations have been possible.

That the Bagworm is adaptable is seen in its general distribution through the Province of Natal and Zululand upon the exotic wattles

(3) I am originally indebted to Mr. C. K. Brain, of the Division of Entomology, for this determination, which has since been confirmed by Mr. Guy K. Marshall.

(4) The term "wattle" is used in its general local acceptance as applying to *Acacia decurrens* and its allies. In this respect it is of Australian origin, the early settlers having used acacia wattles for wattling their clay buildings.

and in the variety of its adopted host plants. Hence it may be said with some assurance that the insect has had ample opportunity to accommodate itself—if so be it ever will accommodate itself—to the varied environments of the Province. This is particularly the case in the midlands (2000 feet to 4000 feet), and the years are not now too few since there have been extensive plantations upon the coast.

From a consideration of the natural features of the country where the insect now abounds, coupled with its almost entire absence in plantations on the coast (5) [for so far none have been found in those of Mount Edgecombe (201 feet) and Winkle Spruit (100 feet)] and with its apparent absence from the middle regions of the dry, warm thorn valleys, it does appear that its natural habitat is the margin of the thorn veld in Natal, and its pestiferous effect in wattle country is limited to those parts where congenial conditions obtain and which impinge upon—without coinciding—with the thorns.

It will not be out of place to consider here those factors which militate against the Bagworm where it should flourish best of all, that is in those parts of the thorn veld where a suitable degree of humidity obtains. It is most obvious that in its natural state "the balance of Nature" is well adjusted, as otherwise we would find veritable plagues of it defoliating the wild thorns throughout the country; but this is not so.

As will be shown later it is a very prolific insect, so that it is not a question of its inability to propagate. Further, it is not a question of want of opportunity, as there exists an ample food supply. Also, it is not a question of want of adaptation to other host plants because the insect flourishes upon the foliage of such widely different plants as the guava, rose, blackberry, apple, and oak. It can only be the natural checks upon it. Amongst these checks I would first of all put a limitation on opportunity; that is to say the native host plant is not heavily foliaged nor are the trees in actual contact, (6) so that the insects may pass readily from one to another. This means that an equal opportunity is not vouchsafed to every one of the young produced. In the second place I would put those insects and animals which prey upon the young directly they leave the protection of the maternal nest.(7) I myself have observed small birds(8) at the period of emergency industriously searching the lower opening of the bags and jumping spiders active in capturing the young before they have had time to make the minute bag in which they early ensconce themselves after leaving the maternal bag and before feeding.(9) Added to these are the many predatory insects which the warm thorn veld abounds in. The third important factor consists of insect parasites, among which two forms predominate, flies and wasps.(10) Perhaps the most

(5) The mere fact that Bagworms have not been found in these plantations proves nothing one way or another. Still it may be contended very plausibly that they will remain immune to severe attack.

(6) See under "Dispersal of Young Bagworms."

(7) See under "Emergence of the Young."

(8) Not identified; called "The Thorn Silver Eye."

(9) Writing to me under date of 31st October, 1912, Mr. Herbert Mayne, Seven Oaks, says: "I believe the young Bagworms take refuge in their silk ladder to avoid ants and other crawling insects, who would otherwise devour them. This, however, is no refuge from spiders, and they are therefore able to destroy the minute Bagworms in immense numbers."

(10) Undetermined Tachinids and Ichneumons.

important factor so far as the thorn veld is concerned are predatory animals which dislodge the full-grown worm from the bags and destroy them. Several birds and, I believe, field rats play this rôle.

There is some evidence that the Bagworms also suffer from an obscure disease, perhaps bacterial, possibly diarrhoetic, and there is the parasite fungus recently described by Pole Evans.(11) These factors, however, do not predominate in the thorn veld; they are present undoubtedly, but their potency is reduced by the drier conditions which ordinarily obtain.

All these controls are largely discounted in wattle plantations. Artificially, propagation of the species is encouraged upon the one hand by the proximity of the trees to one another and by the abundance of food supplies; further, there is no restriction of opportunity. Insects and animals which prey upon the young have their opportunities lessened owing to the extra amount of cover, and perchance also the denser canopy of the plantation is not a favourable environment for them, and their opportunity to increase is not proportionately increased. Predatory animals (rats and birds) still play their part against the larger worms in a plantation, and no doubt to a greater extent, but they are equally handicapped. Here, however, the potentiality of both disease and fungus parasite is increased by the mere fact that more moisture exists in the air under the canopy of the plantation; the greater its degree the greater is their potency.

If I am correct in assuming the Bagworm zone to be a limited one it is none the less necessary to endeavour to ascertain what factors come into play other than those already touched upon. It is of course an undisguised fact that insect predominance is influenced by Nature conditions, that is the predominance of this species or of that. This may not always be easy of explanation. Why, for instance, do not the tsetse flies (*Glossina morsitans* and *pallipedes*) thrive further south than Zululand? Why is our bonte tick (*Amblyomma hebraeum*) particularly limited to the thorn veld and the littoral and only an accidental visitor to the high veld, where species which flourish equally with it on the coast still thrive? Why, one might ask, does the mountain bamboo cling to its fastnesses in the Drakensberg?

It has already been shown, however, that the Bagworm exists from sea-level to an elevation of 5000 feet or more, and the question is: What are the permanent opposing factors which prevent it from becoming abundant? The period of emergence of the young may be set down from the 1st of August to the end of September, but, as a rule, the majority of young emerge between the 25th of August and the 25th September. At high altitudes, such as 5000 feet, excessive humidity might well be a controlling factor, but it is equally possible that late frosts are also a constant factor, catching the young when freshly emerged and unprotected by any bag.

At Highlands (5000 feet) Mr. Oats tells me that whilst he has always noticed a few bags sprinkled through the plantations they have never been any more abundant. At the same time, within ten miles as the crow flies, there exists at Estcourt (3833 feet), on the upper fringes of the "thorns," the one permanent Bagworm infestation that I am acquainted with.

(11) *Union Agricultural Journal*, p. 62, vol. iv (1), 1912.

Turning to the coast belt we find the humidity factor predominating. Here it has been shown we not only experience a fairly high rainfall, but also one that is more evenly spread over the four seasons, or at least the periods that represent spring, summer, autumn, and winter. Added thereto we have a moist and warm atmosphere prevailing, or, to put it another way, the proper atmospheric conditions for the exhibition of the greatest potency of parasitic bacteria and fungi and of intestinal troubles.

How far this theory holds good, or rather will hold good, only future experience will show. The fact, however, remains that I have not seen Bagworms of the species under discussion upon the older wattle trees growing here and there upon the littoral, nor have I succeeded in finding any in the coast plantations, although upon several occasions they have been observed on thorns within a few miles of the sea (Malvern, Stanger, and Verulam).

In short, the conclusion which I have arrived at is that there exists a certain optimum degree of humidity which the Bagworm enjoys. Where the atmosphere is regularly less humid (as in the middle thorn veld) it probably cannot flourish. Where it is more humid the insect either does not flourish or it is controlled by the greater potency of its fungus parasites, bacterial and intestinal diseases, which do flourish.

If the question is considered from the point of view of how far these arguments fit in with the position of affairs as obtains in the wattle growing districts it will be found: (*a*) That periods of excessive Bagworm damage coincide with dry summers or immediately follow thereupon; (*b*) in the main mist zones they seldom if ever assume particularly destructive proportions([12]); (*c*) in the minor mist areas the insects incidence is not regularly felt; and (*d*) where the country impinges on the thorn veld they are regularly abundant and assume their most destructive proportions.([13]) This leads one to postulate that, so far as the Bagworm factor is concerned, the parts most suited to wattle culture are the moisture-catching ridges of the coast and midlands. Incidentally it follows that the plantations most suited to the Bagworms are those where conditions approach nearest thorn veld of between 2000 and 4000 feet.

([12]) The wattle plantations at Hilton Road, on the front of the fourth terrace, have been infested with Bagworm to the writer's knowledge since 1898, and no really serious attack has eventuated.

([13]) The following remarks by well-known Natal farmers bearing upon this discussion are quoted from letters before me:—

(*a*) "I have watched these insects rather closely and have come to the conclusion that the greatest enemy they have is late frosts. Next to this, spiders destroy them more than anything else. As an illustration: This year the Bagworm had a splendid hatching owing to the warm, dry weather in early September, and they came out in millions. Then just after they were mostly hatched we had a cold snap with frost as late as 5th October, with the result that all this hatching were caught without bags and exterminated." (H. Mayne, Seven Oaks, 31st October, 1912.)

(*b*) "At Hilton Road there is very little frost and I do not think it affects the Bagworm there. I think the damp, wet mists are either against the insects increasing as they are doing in the drier districts, or the mists and soil help on the trees to such an extent that the damage done does not show to such an extent as it does in the drier districts." (J. A. Pope Ellis, 16th November, 1912.)

(*c*) "From my observations the farms bordering on the thorn country seem much worse for Bagworm than those in the higher country. There seems to be something about the soil and locality that suits them" (John Marwick, Richmond, 7th November, 1912.)

Reverting to the native forests of the country which are found clinging to the south-eastern slopes of the hills of the midlands (country to which the name "yellow-wood belt" has been assigned, and which has been recognized as the most suitable portion for wattle culture), we find them occupying the points where the greatest amount of rainfall should be looked for and also the most frequent mists. If we enter them we find the soil and atmosphere always moist, the dense canopy preventing excessive evaporation and preserving the moisture. Furthermore, their growth has incidentally led to a greater deposition of moisture, because they keep down the temperature of the hills they clothe. Naturally, they provide the ideal conditions for the growth of fungi and the like, and here these organisms abound. The wattle has not the canopy, even in plantation form, that the natural forest has, nor has it the liana and undergrowth; moreover, it is a great feeder and tends to dry up the soil rather than to keep it moist. Now it is a matter of common observation that vegetable parasitism is found more prevalent in fairly aged plantations (five to six years) with a good canopy where there is equally present a ground flora of cryptogamic plants. Such plantations are only those situated where summer mists are particularly frequent.

Such then are the observations upon which the optimistic idea, with which I premised, is based.

With a view to ascertaining how far the observations fitted in with the ideas of wattle planters a circular letter was recently sent to some 123 planters. From some of these replies I have already made extracts, and the general weight of evidence is in favour of the several conclusions enumerated but a little above. From among the more applicable statements I abstract the following (14):—

(a) With regard to the fungus parasite, I consider that there is no question that this alone, in my own plantations, has been the controlling factor against gross-infestation,(15) thus making Bagworm attack entirely negligible. I have picked many of the bags from my own trees and find the insect to contain nothing but fungus.

Speaking as a layman and naturally feeling a certain amount of diffidence in expressing an opinion, I would like to say that your theory as to the atmospheric conditions appeals to me and seems only reasonable. One cannot but have noticed, if one is of an observant disposition, the suitability of moist conditions for the spread of various other fungi. I have heard of one plantation that was so ruined by Bagworms that it would not pay to harvest. This was upon an open flat with no hills in the immediate vicinity, and the gross-infestation spoken of may in all probability have been due to the want of damp conditions.

(b) Elevation of plantation 2350 feet, mists common and general, Bagworm more noticeable one year than another,

(14) None of the extracts of my correspondents given throughout these notes are to be regarded as selected to support any suggestion or idea of the writer. Neither have any indicating an opposite view been suppressed. Not having the permission of my correspondents to do so, I have made a point of not mentioning their names, and have been as careful as possible to use their own phraseology.

(15) The term "gross-infestation" is used frequently throughout the following discussion, and will be more fully described later.

but a negligible quantity. I cannot say definitely whether its abundance coincides with dry seasons, but have been under the impression that it was more noticeable in dry than wet years.

(*c*) I can only confirm your opinion that high mist belts seem less suitable to Bagworm. The climate here (3500 feet) being cold and damp, and mists common and general over planted areas. I do not anticipate any trouble from Bagworm.

(*d*) Two wattle plantations are at an elevation respectively of 3500 feet and 2200 feet. The first is 1600 acres and the lower 200 acres in extent. The higher is very misty, the lower is all low land with no misty spots. In the higher plantation Bagworm is not abundant and has not been worth considering up to now; in the lower plantation it is an annual nuisance and is very bad.

(*e*) Plantation on high veld (3500 feet), comprising 600 acres of trees of various ages. Mists are common and come very often. In my experience the Bagworm is not an annual nuisance, but you will always find a few here and there.

(*f*) Plantation of 500 acres (4000 feet). Mists common and general. Bagworm not abundant, so few on the trees that they are not worth worrying about.

(*g*) Plantation 800 acres (4200 to 4500 feet). Mists common and general. A few Bagworms are noticed every year, but very few indeed, and there seems to be no apparent increase.

(*h*) Plantation 650-700 acres (4500 feet). Mists very common indeed and general. The Bagworm is not abundant, but has been present since the trees were eighteen months old. We are right on the edge of the thorns district (about three miles), and I believe the infestation, such as it is, is due to the near proximity of the indigenous mimosa.[16]

As to whether the Bagworm is more abundant in a dry or a wet season there is a difference of opinion, but the weight of evidence is in favour of the conclusion that dry seasons favour the increase of the insect, as will appear from the following summary:—

FOR.

1. (3500-4500 feet). More observed in dry than wet seasons.
2. (4000 feet). Have had no bad Bagworm years.
3. (3500 feet). They vary somewhat, but are bad in dry summers.
4. (3500 feet). More in dry summers.
5. (3500 feet). Have always observed that the pest is worse at droughty periods.
6. (3600 feet). I reckon dry summers (coincide with bad seasons).
7. (3200 feet). Dry summer.
8. (3400 feet). Always worst in dry seasons.
9. (3400 feet). Bad in dry summers.
10. (3400 feet). Last year (1911-12) was the worst I have experienced; it is the outcome of the dry seasons.
11. (New Hanover). Usually worse in dry seasons.

(16) The difference in elevation is 2000 feet or more.—C. F.

12. (3200-3400 feet). Have noticed always if a droughty summer Bagworm is worse.
13. (4000 feet). Bad Bagworm years coincide generally with dry summers.
14. [See under (*a*) above].
15. Had Bagworm in 1909, when it was a droughty summer, never since.

AGAINST.

1. (3000 feet). Mists common and general. Bagworm bad occasionally in patches and at irregular periods. Dry or wet seasons make no difference.
2. (3000 feet). Mists rarer of late years. The Bagworms do not seem to be handicapped in our district by wet, as mists are getting rare, because last summer (1911-12) could not be called dry, but the Bagworm had a good time.
3. (Harden Heights). Mists common and general. Last year (1910-11) and this year (1911-12) Bagworm has been bad, this year the worst, and we have had lots of rain this year.
4. (3600 feet). Mists common, the highest parts getting the most. I do not think weather has anything to do with the quantity of Bagworm.

With a view to ascertaining whether any particular year could be fixed upon as one of remarkable Bagworm abundance the question was asked, but found few responses. There is no doubt that Bagworms showed a distinct ascendancy in the New Hanover district during the past two seasons, 1910-11 and 1911-12; and, if not in the 1910 spring, at least in those of 1911 and 1912, phenomenal "wind-spread," accompanied by gross-infestation, most remarkable in connection with young plantations, has been experienced.

The following replies are all that I have had:—

1. The last four seasons have been bad (1908-09, 1909-10, 1910-11, 1911-12).
2. Latterly it has been an annual nuisance, and very bad the last two years (1910-11, 1911-12).
3. It has been an annual nuisance for the last three seasons (1909-10, 1910-11, 1911-12).
4. It has been an annual nuisance for the past three seasons. It made its first appearance on my farm in 1909, and was very bad in 1909 and 1910, but not so bad the following year.
5. 1908 and 1911 have been the worst years.
6. 1902 or 1903 were bad years, also 1910, 1911, and 1912. We had a bad attack prior to 1902, but cannot remember the date.
7. Bagworm was prevalent about the year 1897 on 150 acres, since then no trouble has been experienced.
8. 1911 a bad year.

It would fit in very nicely here if one could show that climatic vagaries make for an increase or a diminution of the insect as the case may be. That, in short, good years are bad for the Bagworm and bad years assure its ascendancy.

But to prove this upon historical data is impossible, because the exact data required does not exist. True there are numerous records in respect to the number of wet days and the rainfall from many Natal stations, but it does not appear to be altogether a question of rainfall as one of cloudy days and mist conditions; upon these the records are silent.

A comparison of the rainfall of New Hanover for instance with parts where Bagworms are not at present troublesome does not reveal any striking difference. There can be little doubt, however, that if it were possible to compare humidity records from this point with others, from, say, Hilton Road, considerable differences must appear.

"A good year" or "a bad year" is very much a figure of speech, and often of very local import. It may apply to a season or it may apply to the calendar year. Thus the year 1912 was a notoriously bad one throughout South Africa, because the summer rains finished early and the spring rains came late. This point may be illustrated from the New Hanover records, which show that as between the 1st March and the 31st October (eight months) 9.07 inches of rain fell. The records for the same period for sixteen years past are as follows:—

1897—15.62	1903—11.39	1909—16.81
1898—15.78	1904— 9.73	1910—20.97
1899—13.24	1905—17.71	1911—22.84
1900—11.52	1906—14.58	1912— 9.07
1901—23.08	1907—20.01	
1902—14.38	1908—21.53	

Taking these figures as a guide, one would be led to the conclusion that the wattle plantations would feel the defoliation effect more in 1912, 1904, 1903, and 1900 than in the other seasons. Here we find that the rainfall for the three months succeeding defoliation (March, April, and May) in 1912 was 2.29, 2.49, 2.12, or a total of 6.90 inches. In 1904 it was 5.06, 0.48, 0.20, or a total of 5.74, but here the good fall in March would have a very rejuvenating effect. In 1903 it was 1.42 5.90, 0.10, or a total of 7.42. The April rainfall of 5.90 inches would do much good, but in view of the fact that the January rainfall for 1903 was the lowest upon record (0.52 inches), it was conceivably a bad year, as is stated by observant growers.

In 1900 the rainfall of the above months was 4.30, 1.60, and 0.15, a total of 5.05. Here the March rainfall is good and rejuvenating, but the rainfall for January was 3.86 and February 2.56, both low records.

The matter of humidity effect upon the Wattle Bagworm is therefore one which appears to play an important part and at the same time one which calls for much further inquiry.

(To be continued.)

Recent Soil Investigation in the Cape Province.

By Dr. C. F. JURITZ, M.A., F.I.C., Chief Chemist, Cape Province.

A FEW years ago the writer contributed to the *Cape Agricultural Journal* a series of twelve articles descriptive of the work that had been done in the Cape Government Laboratories in connection with the analysis, chemical and physical, of the agricultural soils of the Cape Province.* These articles were subsequently published in book form under the title "A Study of the Agricultural Soils of the Cape Colony." Therein were discussed analyses of somewhat over 800 soil samples collected in sixty-four magisterial divisions and districts of the Province. Nominally, the period occupied in the work there described embraced the years 1893 to 1907—i.e. ostensibly fifteen years. Actually, the bulk of the work was carried out in less than half that time, viz., 1893 to 1900; after that at first the war and then the financial depression very seriously interfered with the prosecution of soil investigation.

Four years have gone by since the analytical results obtained from those 800 soils were published, and, although the Cape Laboratories have now ceased to lay themselves out specially for soil work, a number of results obtained from soils collected or procured prior to Union still await publication in connected form. These results, based upon 272 additional soil samples, bringing up the collated record to the end of 1912, I propose to arrange in order in the following pages and briefly to discuss. Amongst these are not included fifty-five analyses of soils from the Orange Free State which have been separately dealt with in a paper by myself entitled "Chlorosis in Orchards near Bloemfontein" in the December, 1912, and January, 1913, issues of the *Union Agricultural Journal*, and in one by Mr. J. Muller on the "Kopjes Irrigation Scheme" in the issue for April of the current year.

In my previously published record of soil work at the Cape, special chapters were devoted to the discussion of agricultural chemical methods, to the geological relations of the soil and its plant food content, to the occurrence of brack or alkali in soils, and to the physical composition of soils. These subjects will not again be discussed in the following pages, but in a few cases certain of the points involved will be incidentally touched upon. In connection with such points it will be necessary to make rather frequent reference to remarks made in the former publication. Such references will also be needed in order to link up some of the more recent results with earlier work in the same districts.

For the most part the work forming the subject of the present series of notes was carried out by Mr. W. Versfeld, B.A., B.Sc., in the Capetown Laboratory, and by Mr. E. V. Flack in the Grahamstown Laboratory. To these members of my staff acknowledgments are due for the larger number of analyses here recorded, as well as to other laboratory officers who have contributed thereto in minor degree.

* Vide *Cape of Good Hope Agricultural Journal*, July, 1907, to June, 1908.

The following list indicates the divisions or districts from which the samples described in the following pages were taken and the number of samples analysed in each case. The districts marked with an asterisk were not included amongst those from which samples had been taken at the time when the 1907-1908 publication was issued. The list gives, in addition to the name of the division or district, also the names of the various farms or other localities whence samples were collected:—

ALBANY:		
Gletwyn	4	
Blauwkrans ...	5	
Heatherton Towers	2	
Fort Brown ...	2	
Palmiet	1	
Sidbury	1	
	—	15
BARKLY WEST:		
488	6	
Blue Bank ...	2	
	—	8
***BATHURST:**		
Allandale ...	4	
Waldon	2	
New Bristol ...	3	
Benholm	1	
Clumber	3	
Trappes Valley ...	2	
Hamilton ...	2	
	—	17
BEAUFORT WEST:		
—	1	
—	1	
	—	2
BRITSTOWN:		
Houwater ...	13	
	—	13
CAPE:		
Tygerberg ...	5	
Bel Ombre ...	2	
Groot Constantia	14	
	—	21
CATHCART:		
Bontebok Flats ...	1	
—	1	
Hove	6	
	—	8
CERES:		
The Oaks... ...	2	
Klipfontein ...	1	
Zwaarmond ...	1	
	—	4
CLANWILLIAM:		
Zeekoevlei ...	2	
Damplaats ...	1	
	—	3
COLESBERG:		
Oorlogspoort ...	1	
Olivewood ...	1	
	—	2
***CRADOCK:**		
Roodewal ...	1	
Eerste Verlies ...	1	
	—	2
Carried forward		95
Brought forward		95
***EAST LONDON:**		
Gonubie Park ...	10	
Barber's Kloof ...	4	
	—	14
HANOVER:		
Krugers Poort ...	20	
	—	20
HERBERT:		
Draaihoek ...	9	
Smithfield ...	2	
Mazelsfontein ...	3	
	—	14
HUMANSDORP:		
Long Kloof ...	1	
Thescombe ...	2	
	—	3
KIMBERLEY:		
Sydney	3	
	—	3
KINGWILLIAMSTOWN:		
—	1	
Evelyn Valley ...	1	
	—	2
MACLEAR:		
Narrow Vale ...	2	
Umga Flats ...	7	
Elands Height ...	2	
Kendal	1	
Cornlands ...	1	
Fairbridge ...	1	
Truro	2	
Selo	1	
Block 10	2	
Feltham	1	
Goodwood ...	2	
Wainwright ...	2	
—	2	
Fairlight... ...	1	
Orpen	1	
Middleridge ...	1	
	—	29
NAMAQUALAND:		
Henkries... ...	1	
	—	1
OUDTSHOORN:		
Kansa Flats ...	5	
Vlakte Flats ...	2	
	—	7
PAARL:		
Rust en Vrede ...	8	
Groot Drakenstein	1	
Champagne ...	1	
	—	10
Carried forward		198
Brought forward		198
***PORT ELIZABETH:**		
Zwartkops ...	4	
	—	4
***PRINCE ALBERT:**		
Klein Kruidfontein	1	
	—	1
QUEENSTOWN:		
Harrison	4	
	—	4
RIVERSDALE:		
—	2	
	—	2
ROBERTSON:		
Willem Nels Rivier	2	
Vrolykheid ...	1	
Gov. Exp. Farm...	5	
	—	8
STELLENBOSCH:		
Lourensford ...	1	
Zeekoevlei ...	1	
	—	2
UITENHAGE:		
Mount Vista ...	1	
Belmont	4	
Headlands ...	4	
—	4	
	—	13
***VANRHYNSDORP:**		
Houdmoed ...	3	
Vredendal ...	4	
Kamkoes... ...	1	
	—	8
VICTORIA EAST:		
—	2	
	—	2
VRYBURG:		
Palmyra	2	
	—	2
WORCESTER:		
Leipzig	4	
	—	4
***XALANGA:**		
Cala	12	
	—	12
ORANGE FREE STATE:		
Waaihoek ...	6	
	—	6
TRANSVAAL:		
Potchefstroom ...	4	
	—	4
RHODESIA... ...		1
		271

ALBANY.

Nos. 1 to 4 were taken from Mr. J. Jolly's farm Gletwyn. Of these, Nos. 1 and 2 were collected respectively from a poor and from a good portion of the citrus orchard, No. 3 from an apple orchard in a valley, and No. 4 from an apple orchard on the flats.

In connection with an occurrence of chlorosis in the orange orchard of Mr. T. Palmer, at Blauwkrans, an investigation into the nature of the soil was made, and a full report was subsequently published in Mr. J. Muller's paper on "Yellowing of Citrus Trees" in the February, 1909, issue of the *Cape Agricultural Journal*. The soil of this orchard was a slightly reddish, very deep sandy loam, and, below the surface foot, consisted mainly of sand. As far as moisture was concerned, it appeared in good condition. The appearance of the soil suggested that very heavy manuring with proper fertilizers would be required in order to prevent soil exhaustion. Previously manuring did not seem to have been efficiently carried out. One of the trees most affected was chosen, and, at a distance of 2½ feet from the stem, a hole about 18 inches square and 54 inches deep was dug. Sample No. 5 represents the surface 18 inches of soil at this point, No. 6 being the next, and No. 7 the third 18 inches. The soil was uniformly moist and apparently of the same texture throughout its profile, or, if there were any change, becoming more clayey with increasing depth. Nos. 8 and 9 represent average samples of the soil from a similar hole dug near a perfectly healthy tree well laden with oranges, No. 8 representing the surface 18 inches and No. 9 the 18 inches immediately below.

Nos. 10 and 11 were both alluvial soils of good depth collected on the farm Heatherton Towers. No. 10 was taken from a 15-acre plot adjoining the Botha's River, and had never been manured; No. 11 was collected immediately below the homestead. Nos. 12 and 13 were taken at the proposed Experiment Farm at Fort Brown on the Fish River. Of these two soils the former was collected to a depth of 12 inches from a spot in the middle of a level patch above the bridge on the left bank of the river. For the first 8 inches this soil is fairly loose, but lower down becomes very hard and clayey. The characteristics of the lands around are represented as being very fertile, and the veld is said to be extremely good, even in times of great drought. No. 13 was taken further west from lands in the bend of the river, which may be easily put under irrigation; it is apparently a sandier soil to 10 inches in depth when the harder clay bed is struck.

No. 14 was collected on the farm Palmiet, Riebeek East, and represents a soil on which it was intended to grow lemons.

No. 15 represented a fine dark brown sandy soil from Sidbury.

Analysed, with a view to ascertaining their general agricultural capabilities, by extraction with hydrochloric acid, according to the standard method described in my book on the "Agricultural Soils of the Cape Colony,"* these samples yielded the following results:—

* Pp. 13-15.

No.	Percentage of Field Sample.	Percentage of Soil sifted through 1 mm. Sieve.				Percentage of Soil sifted through ½ mm. sieve.			
	Fine earth below ½ mm.	Water.	Organic Matter.	Chlorine.	Nitrogen.	Lime.	Magnesia.	Potash.	Phosphoric Oxide.
1	98·7	1·56	2·92	·012	·084	·042	—	·070	·129
2	96·1	2·30	4·97	·013	·105	·046	—	·096	·127
3	98·5	2·76	5·18	·013	·112	·050	—	·112	·184
4	91·0	1·49	2·36	·011	·070	·086	—	·040	·075
5	91·1	·40	·84	·008	·018	·014	—	·037	·056
6	91·9	·47	·86	·018	·018	·016	—	·035	·032
7	90·7	·88	1·42	·022	·070	·018	—	·048	·083
8	94·8	·75	1·29	·020	·018	·024	—	·036	·050
9	94·3	1·02	1·44	·018	·035	·040		·028	·073
10	95·6	—	—	·005	—	·194	—	—	·097
11	94·7	—	—	·006	—	·082	—	—	·067
12	99·8	·95	2·01	·013	·155	·068	—	·078	·044
13	99·7	1·62	3·09	·006	·180	·382		·154	·061
14	90·0	1·52	3·12	·005	·108	·184		·052	·045
15	99·4	2·17	4·00	·013	·121	·074	·063	·076	·052

Nos. 1 and 4 are somewhat poor in nitrogen, and Nos. 1, 2, and 4 have relatively low proportions of potash. No. 4 has a fair amount of phosphates, but all four Gletwyn soils are deficient in lime.

Nos. 5, 6, 7, 8, and 9 are very poor all round in their stock of plant food. The lime in the healthy patch is just double that under the affected tree, and the former contains more clay, is of a finer texture, would hold moisture longer, and be better able to retain fertilizing ingredients under repeated irrigation.

Partial mechanical analyses were made of Nos. 12 and 13 with the following percentage results:—

No.	Pebbles.	Gravel.		Coarse Sand.	Fine Earth.
	> 3 mm.	Coarse. 3-2 mm.	Fine. 2-1 mm.	1-½ mm.	< ½ mm.
12	·03	·01	·03	·15	99·78
13	·02	·03	·06	·23	99·66

Chemically, No. 12 is a rather poor soil, and No. 13, although not more than fairly supplied with phosphoric oxide, is, in other respects, a good soil. No. 14 is poor in plant food, particularly as regards potash and phosphoric oxide. No. 15 is poor in all its mineral plant food constituents.

BARKLY WEST.

Nos. 16 to 21 were collected from farm No. 48B in Ward No. 1, at Gong Gong, in the Barkly West Division. They were taken from

an orchard of young trees aged between three and four years, and irrigated by water pumped from the Vaal River, the ground being thoroughly cultivated. Some years ago there had been a considerable amount of brack in the soil, but with constant cultivation it had almost disappeared. The soil had formerly been manured, but the only treatment received during the last five years was a dressing of fine bone meal two years ago. The surrounding veld is sweet, and the soil sampled, prior to cultivation, grew mimosas and couch grass. Nos. 16, 18, and 20 were as surface soils, and Nos. 17, 19, and 21 their respective sub-soils. The average depth of the surface soil *in situ* is 12 inches, and that of the sub-soil 10 inches, the latter consisting of lime and clay. No. 16 was a dark grey, almost black, soil, rather loose and friable; its sub-soil, No. 17, though also dark grey, was lighter in colour than No. 16 and contained a considerable number of soft white lumps of carbonate of lime. Nos. 18 and 19 were dark brown loamy soils, more clayey, apparently, than the previous samples. Nos. 20 and 21 were reddish-brown soils similar to Nos. 18 and 19.

Two samples of soil, Nos. 22 and 23, were collected from level country, where stable and kraal manure are generally used, on the farm Blue Bank (H.V. 1 and 2). The former was a reddish-coloured, very porous, fine, sandy, virgin soil, locally known as red ground, from a sweet veld flat about fifty feet above the river level. Fruits, vegetables, and cereals are grown to great perfection in the neighbourhood. This soil apparently contains very little clay, is at least 20 feet deep, and occurs in the middle of the farm where sweet buffalo grass and some Karroo bushes grow. Sample No. 23 also represented a virgin soil, and was taken from flats extending to half a mile from the river bank. The soil varies in depth from three or four to thirty feet, and shows slight indications of brack. Its colour is more greyish, and it is much finer in grain than No. 22. Its indigenous vegetation comprises sweet buffalo grass, with ganna bushes and mimosa trees. The land at this place has been used for stock farming only.

By the usual hydrochloric acid extraction process the following analytical results were obtained:—

No.	Percentage of Field Sample.	Percentage of Soil sifted through 1 mm. Sieve.				Percentage of Soil sifted through ½ mm. Sieve.			
	Fine Earth below ½ mm.	Water.	Organic Matter.	Chlorine.	Nitrogen.	Lime.	Magnesia.	Potash.	Phosphoric Oxide.
16	99·40	2·33	4·19	·007	·125	·880	·521	·060	·064
17	98·28	2·04	4·31	·004	·055	1·860	·128	·060	·028
18	99·05	1·76	3·76	·003	·092	·302	·475	·054	·052
19	99·66	1·94	2·50	·005	·056	·340	·409	·052	·033
20	98·57	2·46	4·24	·004	·098	·380	·387	·057	·079
21	98·33	2·05	3·42	·007	·056	·280	·551	·043	·054
22	99·37	·83	1·18	·0071	·032	·062	·071	·027	·019
23	99·47	3·59	2·60	·0085	·056	·290	·260	·024	·036

Determinations of the total water-soluble salts in these soils gave the following results:—

No.	Total soluble salts.
16	·090
17	·070
18	·052
19	·072
20	·056
21	·070
22	·032
23	·048

The following partial mechanical analyses were also made:—

No.	Pebbles > 3 mm.	Gravel and Coarse Sand 3 -·5 mm.	Fine Earth < ·5 mm.	Nature of Pebbles and Gravel.
16	·14	·46	99·40	Quartz, slate, and lime tufa.
17	·07	1·63	98·28	Almost entirely lime tufa.
18	·15	·80	99·05	Quartz grains, slate, and decomposed dolerite.
19	·06	·28	99·66	
20	·12	1·31	98·57	
21	·19	1·48	98·33	
22	Nil	·63	99·37	Quartz grains.
23	Nil	·53	99·47	" "

The most noticeable feature of the plant food content in the Gong Gong soils is the fact that in every case the sub-soil is poorer in nitrogen and phosphates than the surface soil. Even in the surface soil phosphoric oxide is present only in moderate amount, but lower down it becomes inadequate. Nitrogen too is present in fair quantity in the surface soils, but here again the sub-soils are poor. Apparently the soils had received dressings of phosphatic and nitrogenous manures, which had not been mixed with the soil to any considerable depth. The amounts of lime and magnesia are high, and the comparatively small amount of magnesia in No. 17 is the more remarkable seeing that sample contained the largest proportion of lime. Potash is inclined to be low in these soils, and could advantageously be increased. As suited to a fruit orchard, where slow acting manures are required, the Government Agriculturist recommended the application of a dressing producing 7.7 lb. of nitrogen, 53 lb. of phosphoric oxide, and 50 lb. of potash per acre, made up by sowing and ploughing in a mixture of 200 lb. of bone meal, 150 lb. of 17 per cent. superphosphate, and 100 lb. of sulphate of potash.

Physically, Nos. 22 and 23 may be described as excellent, No. 23 being the better of the two. It is composed largely of fine silt rather than clay, and is therefore not too fine grained to prevent the free circulation of air and water, nor is it coarse grained enough to allow of soluble plant food being easily leached out, though this defect may exist to a certain extent in No. 22. In every case, except potash, No. 23 is found to be the richer of the two soils in plant food; at the same time neither soil is adequately supplied in this respect. The proportions of nitrogen, potash, and phosphoric oxide should all be considerably increased in both soils, and in No. 21 lime also is deficient.

As far as brack in the Barkly West soils is concerned, the proportions of chlorine and of total soluble salts were so low that the danger of brack seemed remote. But it must never be forgotten that there is a possibility, in cases where only the surface twelve or twenty-four inches of soil are examined, that at lower depths greater quantities of soluble salts may be accumulated, with the liability to be brought to the surface by capillary water, especially after irrigation.

BATHURST.

During a visit to Grahamstown early in 1909, a deputation representing the Bathurst Farmers' Union waited on me and directed my attention to the gradual but steady deterioration of the pineapple crops in the district, expressing the view that the trouble probably originated with the soil, and requesting me to have a full investigation thereof undertaken. Mr. Muller, who was then in charge of the Grahamstown Laboratory, was at once directed by me to take the subject in hand with all possible speed, but the smallness of the staff then at his disposal effectually prevented the immediate carrying out of this investigation. However, he lost no time in visiting several pineries and collecting a number of typical soils for the purpose of examination when opportunity should allow. It was not until early in 1911 that this opportunity came, consequent on the increase of the Grahamstown staff. Unfortunately, only a few weeks later it became necessary to transfer Mr. Muller permanently to Capetown, and the investigation, which had not proceeded beyond the performance of a series of mechanical analyses of the soils, came to a complete stand. Dr. Lewis then succeeded Mr. Muller, and I directed him to take up the thread of the investigation. After acquainting himself with the circumstances, he concluded that it would be preferable to start the whole investigation over again from the beginning. This was accordingly done, and a fully detailed report, giving the results of Dr. Lewis's investigations, appeared in the *Union Agricultural Journal* of March, 1912.* In order to have the present record of Cape soil analyses complete, a summary of that portion of Dr. Lewis's work which dealt with the soils of the pineries is here given, together with results of analyses of a few soils from apple and orange orchards in the vicinity, to investigate which occasion was taken at the same time. The first place visited was Messrs. Oates & Sons' farm Allandale, in the Kaap River Valley. Here Nos. 24, 25, 26, and 27 were taken. No. 24 was taken from a large apple orchard, and represents alluvial soil along the river, where each tree had been fertilized two years previously with 4 lb. of lime. The trees were bearing well. No. 25 was taken from a hill slope in the same orchard. The soil here is shallow, and the trees, which do not bear well were fertilized with kraal manure in 1909. No. 26 was taken from a pinery on the same farm, about nine years old, and in fairly good bearing, although the pineapples are diminishing in size. No. 27 was from a young pinery, four years old, which was doing well. The soil is a sandy loam, both on Allandale and on Mr. W. Purdon's farm Waldon. The pinery on the latter is situated on old grass veld, and is from seven to nine years old. Here Nos. 28 and 29 were taken, the former from a portion which gives good crops, the latter from a poor patch, where

* Pp. 357–371.

the bushes are small and bear badly. On the farm New Bristol, belonging to Mr. S. Bartlett, the eight years' old pinery is in poor bearing—about four pines per bush per annum; the soil is inclined to be sandy, and is from 12 to 16 inches deep. Sample No. 30 was taken here. From the orange orchard Nos. 31 and 32 were collected. The orchard is on a deep, alluvial soil in a valley. No. 31 was taken from a good part of the orchard, and No. 32 from a poor patch, where the leaves are yellow and the crop very small. Sample No. 33 was taken on the farm Benholm from an old pinery now being replanted. The soil is of good open texture at the surface, and becomes more clayey to a depth of 30 inches, when it passes into gravel. Nos. 34, 35, and 36 were collected at Clumber, No. 34 being from Mr. Ashton Bradfield's pinery, which is a good one, about eight years old, on deep soil. No. 35 was taken from the apple orchard of Mr. E. J. Elliott on the farm Nottingham Party. The soil is a fairly deep, light-coloured alluvial loam. The trees are nine years old, have never been manured, and yield good crops. No. 36 is from similar but stiffer soil in the orchard of Mr. J. Bradfield at Welford. The trees are eight to ten years old, and bear well. From Mr. A. J. Ansley's farm, Trappes Valley, Nos. 37 and 38 were taken, the former from an orchard of seven years' old apple trees, which bear poorly, and had been given a little basic slag during the previous year, the latter from a good orchard of very old trees which still yield splendid crops. Nos. 39 and 40 were collected by Mr. E. H. Purdon on his farm Hamilton, No. 39 from a young pinery, and No. 40 from an apple orchard eight years old, which bears very good crops.

The following analytical results were obtained from the above series of Bathurst soils by the usual method of agricultural chemical analyses adopted in these laboratories:—

No.	Percentage of Field Sample.	Percentage of Soil sifted through 1 mm. Sieve.				Percentage of Soil sifted through ½ mm. Sieve.			
	Fine Earth below ½ mm.	Water.	Organic Matter.	Chlorine.	Nitrogen.	Lime.	Magnesia.	Potash.	Phosphoric Oxide.
24	97·5	1·38	3·63	·022	·098	·204	—	·043	·042
25	94·8	1·70	3·48	·021	·126	·128	—	·081	·039
26	99·1	1·43	3·05	·020	·098	·100	—	·032	·033
27	95·5	2·19	5·08	·022	·056	·084	—	·067	·046
28	98·7	3·03	4·90	·018	·126	·086	—	·062	·050
29	98·3	2·07	2·68	·019	·070	·060	—	·053	·026
30	95·0	1·19	2·29	·016	·063	·030	—	·038	·042
31	97·3	·69	1·19	·014	·042	·038	—	·034	·024
32	95·4	·43	·74	·015	·049	·020	—	·031	·043
33	95·0	6·05	4·72	·018	·140	·050	—	·063	·087
34	95·6	5·38	4·98	·018	·143	·048	—	·068	·068
35	98·7	2·48	2·81	·018	·084	·040	—	·083	·073
36	98·0	5·24	3·43	·018	·098	·082	—	·107	·067
37	94·8	2·18	1·79	·017	·070	·020	—	·044	·050
38	99·5	3·20	2·58	·014	·084	·086	—	·036	·062
39	98·8	3·30	5·42	·019	·147	·208	—	·093	·066
40	98·1	·97	1·52	·020	·042	·080	—	·046	·041

In the Bathurst pinery soils determinations of potash and phosphoric oxide were made by submitting the soil sifted through a 3 mm. sieve to extraction by 1 per cent. citric acid, with the following percentage results:—

No.	Potash.	Phosphoric Oxide.
26	·004	·009
27	·004	·008
28	·005	·010
29	·006	·010
30	·004	·008
33	·005	·013
34	·004	·013
39	·011	—

Partial mechanical analyses were also made of the pinery soils, and resulted as follows:—

No.	Pebbles. > 3 mm.	Gravel. Coarse 3–2 mm.	Gravel. Fine 2-1 mm.	Sand. Coarse 1–·5 mm.	Sand. Medium ·5–·25 mm.	Sand. Fine ·25–·1 mm.	Sand. Very Fine ·1–·05 mm.	Silt ·03–·005 mm.	Clay < ·005 mm.
26	Nil	Nil	·10	·85	15·90	30·06		53·09	
27	·31	·33	·93	2·90	10·50	23·34		61·69	
28	·07	·14	·19	·95	6·20	21·84		70·61	
29	Nil	·02	·42	1·31	8·54	31·04		58·67	
30	2·98	·60	·71	·70	11·90	40·70	10·62	24·59	7·20
33	·90	·91	2·09	1·11	5·80	27·20	16·45	37·36	8·18
34	·76	·75	1·96	·91	4·90	21·70	19·26	46·77	9·99
39	·13	·40	·69	1·00			28·78		

Of the orchard soils, Nos. 24, 35, 36, 38, and 40 were stated to be satisfactory in cultivation, while Nos. 25 and 37 were reputed poor. From the analysis it is not apparent why No. 25 should have this reputation, for, though low in phosphoric oxide, that constituent is equally low in No. 24. Dr. Lewis regarded its inferiority as probably due to its situation and shallowness. Between Nos. 37 and 38 there is, however, considerable difference in chemical composition. In No. 37, as in No. 32, the proportion of lime is exceedingly low. The New Bristol soils are poor throughout, and the yellowing is apparently due, moreover, to imperfect drainage and waterlogging of the soil, causing malnutrition. The average composition of these orchard soils shows them to be, on the whole, poor in lime, potash, and phosphoric oxide. Nos. 25, 35, and 36 contain satisfactory percentages of potash, and Nos. 35, 36, and 38 of phosphoric oxide, but No. 24 is the only soil whose lime content is satisfactory. It was suggested that the apple soils would be improved by an application of lime, about 4 lb. to 8 lb. per tree. Nos. 31, 32, and 40 showed deficiency in nitrogen, and potash was required by all the soils except possibly Nos. 25, 35, and 36.

Of the pinery soils, Nos. 39 and 40 are undoubtedly poor all round, and in every pinery soil there is a deficiency of one or more of the necessary plant food constituents.

BEAUFORT WEST.

The samples Nos. 41 and 42 were taken so as to represent the surface two inches of soil in lucerne patches on two different farms where it was noticed that the young shoots of the plant appeared to be corroded at the surface, and the lucerne on these patches was much affected and of a yellow colour, if not actually dying off. In some parts, it was stated, white and black brack were visible to the eye. The percentages of soluble salts in these soils were determined and found to be as follows:—

No.	Sodium Chloride.	Sodium Sulphate.	Sodium Carbonate.	Total Alkali Salts.	Magnesium Chloride.	Magnesium Sulphate.	Magnesium Carbonate.	Calcium Chloride.	Calcium Sulphate.	Calcium Carbonate.	Total soluble salts by analysis.	Total soluble salts by weighing.
41	·033	·021	·029	·083	Nil	Nil	·025	Nil	Nil	·041	·149	·154
42	·048	·047	·214	·309	Nil	Nil	·032	Nil	Nil	·040	·381	·384

BRITSTOWN.

Nos. 43 to 50 represent the successive twelve-inch blocks of soil from the surface down to a depth of eight feet at a spot on one of the Smartt Syndicate farms where the land was growing excellent lucerne. Nos. 51 to 55 were similar twelve-inch blocks representing the first, second, third, fourth, and seventh-foot levels at a place where the lucerne was dying out. Mechanical analyses were made of these two series of soils, and also, as far as was deemed needful, determinations of brack salts in the soil. The analyses for brack salts gave the following percentage results:—

No.	Sodium Chloride.	Sodium Sulphate.	Sodium Carbonate.	Total Alkali Salts.	Calcium Carbonate.	Total Soluble Salts.
43	·013	·010	Nil	·023	·041	·068
46	·070	·060	Nil	·130	·037	·184
50	·246	·216	Nil	·462	·052	·496
51	·019	·018	·049	·086	·021	·128
54	·018	·022	·049	·095	·021	·164
55	·266	·275	·026	·567	·049	·600

Mechanical analyses of all these Britstown soils were performed with the results detailed below calculated on the dry soil:—

No.	Pebbles >3 mm.	Gravel. Coarse 3–2 mm.	Gravel. Fine 2-1 mm.	Sand. Coarse 1–·5 mm	Sand. Medium ·5–·25 mm.	Sand. Fine ·25–·1 mm.	Sand. Very Fine ·1–·05 mm.	Silt ·05–·01 mm.	Fine Silt ·01–·005 mm.	Clay <·005 mm.
43	1·18	·57	1·01	1·44	28·16	38·64	4·49	4·18	9·01	11·32
44	·12	·25	·69	1·04	27·39	41·21	4·29	2·98	7·64	14·32
45	·12	·14	·37	·55	18·93	44·01	5·83	5·72	9·98	14·49
46	1·69	·49	·59	·50	12·10	30·35	5·11	8·78	19·13	21·19
47	·55	·58	·87	·70	6·53	17·59	5·37	11·91	26·07	29·76
48	·75	·45	·59	·50	7·90	8·44	6·57	11·00	29·31	34·44
49	·99	·28	·58	·57	18·44	31·35	5·02	6·14	16·63	20·79
50	3·02	·64	·85	·79	14·49	34·13	5·90	7·10	14·99	18·03
51	·02	·02	·02	·03	1·99	16·44	5·40	7·66	27·45	40·88
52	Nil	Nil	·01	·03	3·60	23·91	6·63	5·35	16·17	44·26
53	·01	Nil	·04	·10	5·04	30·21	9·01	6·53	17·92	31·08
54	·26	·17	·27	·19	7·02	34·20	8·44	7·33	20·99	21·08
55	·26	·22	·33	·24	4·69	23·32	7·09	9·74	25·80	28·29

The proportions of alkali salts in the soils where good lucerne was produced do not differ greatly from that where the lucerne failed; it is true that the soils of the latter series contain sodium carbonate, which is absent from those where the lucerne did well, but although lucerne is very sensitive to sodium carbonate,* it was not considered that this fact sufficed in itself to cause the difference in the crops. It is true also that in the lowest soil levels alkali salts were present in more than a harmless proportion, but this was the case equally where the lucerne was bad and where it was good. Plainly, therefore, this was not the cause of failure, in fact, these large proportions of brack were too deep down in the soil to affect the lucerne injuriously, and the actual cause of the difference in crop seems to be owing to the physical structure rather than to the chemical composition of the soil.

It appeared evident, at the first inspection, that the samples taken from the locality where excellent lucerne was being produced were all loose and apparently sandy, whereas those from the spot where the lucerne was dying out were lumpy and seemingly of a more clayey character. The reason of the failure of the lucerne at the latter place was therefore indicated as having more to do with the physical nature than with its chemical condition, and I have already pointed out above that brack was not the cause. This view was confirmed by the mechanical analysis, as a glance at the above figures given by the two series of soils, Nos. 43 to 50 and 51 to 55, will show. In the following table I have adopted a broader mechanical grading which will show the physical difference in the surface soil layers more

* See experiments quoted in Hilgard's "Soils," p. 467.

clearly. I have also added to these the percentages of moisture and organic matter found in each sample:—

No.	Depth.	Percentage in Absolutely Dry Soil.					Percentage in Air-dry Soil sifted through 1 mm. Sieve.	
		Pebbles > 3 mm.	Gravel 3–1 mm.	Sand 1–·05 mm.	Silt ·05–·005 mm.	Clay < ·005 mm.	Moisture.	Organic Matter.
Good Lucerne:								
43	0–1 ft.	1·18	1·58	72·73	13·18	11·32	2·84	2·52
44	1–2 „	·12	·94	73·93	10·62	14·32	3·25	2·45
45	2–3 „	·12	·51	69·32	15·70	14·49	3·48	3·32
46	3–4 „	1·69	1·08	48·04	27·91	21·19	4·89	6·01
47	4–5 „	·55	1·45	30·19	37·98	29·76	6·09	7·41
48	5–6 „	·75	1·04	23·41	40·31	34·44	5·84	5·87
49	6–7 „	·99	·86	55·48	21·77	20·79	4·19	4·21
50	7–8 „	3·02	1·49	55·31	22·09	18·03	4·16	5·44
Bad Lucerne:								
51	0–1 ft.	·02	·04	23·86	35·11	40·88	4·22	5·72
52	1–2 „	Nil	·01	34·17	21·52	44·26	4·63	4·70
53	2–3 „	·01	·04	44·36	24·45	31·08	4·15	4·30
54	3–4 „	·26	·14	49·65	28·32	21·08	3·34	5·85
55	7 „	·26	·55	35·34	35·54	28·29	4·34	5·62

We see at once from these figures that the soil where the lucerne thrived well was much the looser and sandier of the two, in that soil sand preponderates, while in the soil on which the lucerne crop was a failure the silt and clay make up a much larger proportion than where the crop succeeded. If we compare the proportions of (*a*) medium and fine sand, and (*b*) silt and clay in the two sets of soils, we arrive at very striking results:—

No.	(*a*) Medium and Fine Sand, ·5–·1 mm.	(*b*) Silt and Clay, < ·05 mm.	Proportion of (*b*) if (*a*) = 1.
Good Lucerne:			
43	66·80	24·50	·37
44	68·60	24·94	·36
45	62·94	30·19	·48
46	42·45	49·10	1·16
47	24·12	67·74	2·81
48	16·34	74·75	4·58
49	49·79	42·56	·85
50	48·62	40·12	·83
Bad Lucerne:			
51	18·43	75·99	4·12
52	27·51	65·78	2·39
53	35·25	55·33	1·58
54	41·22	49·40	1·20
55	28·01	63·83	2·28

Taking the four or five feet of soil nearest the surface, it will be seen that the most pronounced difference between the soil yielding good and that yielding bad lucerne is in the surface layers. At a depth of 4 feet there is no practical difference. Obviously, then, the large proportion of fine silt and clay in samples Nos. 51 and 52 is disadvantageous; the soil represented by these samples is too stiff for satisfactory lucerne cultivation, and the remedy would clearly be the admixture of a sufficient proportion of sand. Through stiff clay soils water cannot easily percolate, whereas a soil consisting of comparatively coarse particles possesses the necessary facility for easily disencumbering itself of surplus water. The conclusion with respect to these soils therefore is that the dying out of the lucerne at the one locality was largely, if not entirely, due to the soil being too stiff, and that steps were needed to render that soil more pervious to air and water.

CAPE.

Nos. 56 to 60 were collected from Sir David Graaff's farm at Tygerberg, where manurial and cultural experiments were being conducted by the Agricultural Department. Nos. 56 and 57 were virgin soils, taken respectively from alongside and 200 yards away from a plot planted with lucerne. Nos. 58 and 59 were taken from lots cultivated with barley; No. 59 was from unmanured land, but No. 58 had received two bags of Government guano per three acres. No. 60 was fallow land from a hillside above the last two samples. A general analysis in order to ascertain the proportion of plant food materials in reserve in each of these soils gave the results tabulated below:—

No.	Percentage of Field Sample.	Percentage of Soil sifted through 1 mm. sieve.				Percentage of Soil sifted through ½ mm. sieve.			
	Fine Earth below ½ mm.	Water.	Organic Matter.	Chlorine.	Nitrogen.	Lime.	Magnesia.	Potash.	Phosphoric Oxide.
56	99·5	·30	1·12	·028	·084	·046	·018	·049	·117
57	88·0	·37	2·01	·038	·084	·064	·044	·094	·017
58	98·2	1·29	3·01	·043	·112	·084	·056	·189	·033
59	69·9	·60	1·99	·036	·084	·060	·053	·154	·026
60	93·6	2·34	4·38	·023	·084	·088	·432	·322	·050

Partial mechanical analyses of these soils yielded the following results:—

No.	Pebbles > 3 mm.	Gravel and Coarse Sand 3-·5 mm.	Fine Earth < ·5 mm.
56	·2	·3	29·5
57	·5	·7	98·8
58	·4	1·4	98·2
59	12·7	17·4	69·9
60	1·2	5·2	93·6

On Mr. Rathfelder's farm Bel Ombre, Constantia, two samples of vineyard soil, Nos. 61 and 62, were taken solely for the purpose of moisture determinations. Chlorosis had appeared in the vines, and it was thought possible that this was due to defective aeration of the sub-soil resulting from supersaturation with water. No. 61 was a gravelly loam collected at a depth of 12 inches from the surface, and No. 62 a coarse gravel taken at 24 inches depth. In both cases the amount of moisture present in the soil *in situ* was determined by Whitney's method described on page 745 of my "Notes on Soil Moisture" in the December, 1911, issue of the *Union Agricultural Journal*. The percentages found were:—

No. 61	17·64
No. 62	5·51

The texture of the soil intermediate between these two levels was such as to indicate that the water-content of the intervening soil was below that of No. 61, hence it seemed hardly likely that the chlorosis could have resulted from "wet feet." It was, however, decided to investigate that possibility more closely.

In co-operation with the manager of the Government Wine Farm, Groot Constantia, three sites were selected, and in each case holes were dug to a depth of three feet, four samples being collected in Whitney's tubes, representing the soil at depths of 9, 12, 24, and 36 inches. The tubes were at once sealed, dispatched to the laboratory, and the moisture content of each sample determined forthwith. The samples Nos. 63 to 66 represent the four soil levels at one of the three sites where yellowing of the leaves had appeared. Nos. 67 to 70 were the corresponding samples from a second site where chlorosis had also occurred. These eight samples were collected on the 6th February. A slight shower had fallen on the previous day, but only the 9-inch samples, if any, could have been affected thereby. The results obtained were the following:—

No.	Nature of Soil.	Moisture Percentage.
63	Loose gravelly	9·79
64	Very loose gravelly ...	8·14
65	Gravelly clay	12·89
66	Rather stiff gravelly clay	15·11
67	Loose gravelly	10·66
68	Loose gravelly	9·65
69	More clayey	14·15
70	Stiff gravelly clay ...	15·61

The remaining site was in a vineyard where the vines, for at least seventeen years, had invariably given excellent returns, and where no signs of chlorosis were apparent. There the samples Nos. 71

to 74 were collected, also at depths respectively of 9, 12, 24, and 36 inches, on the 27th February, and their moisture determined with the following results:—

No.	Nature of Soil.	Moisture Percentage.
71	Loose gravelly	6·40
72	Loose gravelly	5·93
73	Loose gravelly clay ...	5·95
74	Loose gravelly clay ...	6·31

The rainfall during the previous six months had been distributed as follows, the figures given denoting inches:—

	Wynberg.		Constantia.	
September...		7·48		7·66
October		4·17		3·42
November...		1·55		1·71
December...		2·15		3·18
January		·49		·14
February—5th	·33		·27	
6th	– –		·01	
14th	·10		·24	
15th	·13		·29	
19th			·01	
21st	–		·02	
22nd	·09		·18	
23rd	–		·01	
		·65		1·03
		16·49		17·14

Two months later sample No. 75 was taken from a patch of vineyard on the Government Farm, Groot Constantia, where the vines were dying. No. 76 was taken from a patch of vineyard in which the vines were apparently healthy, showing no signs of chlorosis. Determinations of humus and humic acid were made in these two soils with the following results expressed in percentages of the soil as sifted through a 3 mm. sieve:—

	Free Humic Acid.	Total Humus.
No. 75	1·89	4·04
No. 76	1·53	3·31

The difference in the amounts of organic acids present was not sufficiently marked to explain the difference in growth of the vines on the soils Nos. 75 and 76.

(To be continued.)

Cattle Dipping at Short Intervals.

By H. E. Laws, B.Sc., F.I.C.

Although dipping has been carried on in this country for a great number of years it was not until the advent of East Coast fever that the question of treating the cattle at a less interval than every fourteen days was undertaken seriously. Circumstances did not demand it. In Natal, and along the coast belt of the Cape Colony, the tick was regarded as a dangerous pest, but—apart from work done in these localities—very few attempts were made to control them, whilst even there total eradication was not the object in view. All that seemed necessary at the time was to devise some method for suppressing the ticks. It was found possible to do this by dipping at fortnightly intervals.

Since it was first discovered by Lounsbury, when investigating this subject in Rhodesia, that East Coast fever was transmitted by the brown tick, and that this tick spends a comparatively short time at each stage of its life-cycle on the host, it has become more generally realized that unless the interval between dippings is reduced considerably the chances of eradicating this variety of tick, and thus preventing the spread of East Coast fever, are very remote indeed. This was realized in Natal first of all, soon after the outbreak of East Coast fever in that Province. Here the interval between dippings has been reduced, in stages, from fourteen to ten, then to seven, and then again later to five days. The fact that even so short an interval as five days was insufficient to prevent the spread of East Coast fever on a farm where the disease has broken out led one to conclude that the life-history of the East Coast fever tick had not been investigated thoroughly.

In view of the spread of the disease, in spite of short interval dipping of cattle, it seemed more than likely that many of the ticks were able to get on to the host after one dipping, feed, and drop off to moult again before the next dipping.

At this time it was known that there were four varieties of brown ticks—*R. appendiculatus; R. capensis; R. simus;* and *R. nitens*—and the red-legged tick (*R. evertsi*) capable transmitting East Coast fever from a sick animal to a healthy one. Of these the last named is a two host tick; it spends its larval and nymphal stages on one animal, after which it drops off, moults a second time on the ground, then spends its adult stage on the host. If the animal on which it spends its larval and nymphal stages is East Coast fever infected it will transmit the disease to the animal on which it spends its adult stage.

This tick spends more than five days on each of its two hosts, and is, in consequence, caught by each dipping at the five days' interval. It is only necessary when dipping at the five-day interval for the dip to be sufficiently strong to kill every tick on the host at the time of dipping to prevent the escape of any tick of this variety.

From the results of further investigations by Watkins-Pitchford* it was proved that the minimum time for the larval brown tick to spend

* "Dipping and Tick Destroying Agents," Part III. By Lt.-Col. H. Watkins-Pitchford F.R.C.V.S., F.R.S.E.

on its host was sixty-eight hours, whilst in its nymphal stage the minimum time spent on the host was seventy-two hours. In the light of this knowledge it was deemed advisable to recommend a three-day interval between dippings, and thus avoid all risk of any variety escaping the dipping. Watkins-Pitchford proved that it was possible to stamp out East Coast fever completely from an infected farm by means of a three-day dipping. Since then three-day dipping has been adopted generally for stamping out the disease, when an outbreak has occurred in Natal and in the Cape Province, but the results obtained—particularly in the latter Province—have not been an unqualified success. The reasons for this are many. In the first place larval and nymphal red ticks are usually found low down in the hollow of the ear, whilst browns in all the three stages infest, both the inside and outside, the ears and around the eyes. Now, the entrance to many dipping baths is so constructed that it is possible for animals to pass through without getting their heads and ears wet, so that many ticks escape the dipping and are therefore enabled to engorge and drop off without interruption. If dipping tanks are constructed so that every animal is obliged to take a header this chance of escape of the tick is removed; but there still remains another serious loophole. The strength of dip recommended for three-day dipping is one part arsenious oxide to 1250 parts of water—1 lb. arsenite of soda (80 per cent. arsenious oxide) to 100 gallons of water. Watkins-Pitchford found that the application every three days of such a solution of arsenic combined with an emulsion was sufficiently strong to stamp out East Coast fever. It killed all the small ticks on the animal, and by its cumulative effect prevented any further pathogenic ticks from feeding and transmitting the disease. A dip which contains no emulsion does not behave in the same way; it merely penetrates to the skin in patches, killing the ticks, and, by its cumulative effects, preventing infection by pathogenic ticks only in those patches where the dip penetrates. To secure uniform action all over the skin of the animal it is necessary to use a dip containing an emulsion, hence the difference between the results obtained by Watkins-Pitchford and those secured on infested farms where a non-emulsion dip has been used. In the latter case with such a weak dip as one part arsenic to 1250 parts of water many ticks escape alive, whilst other pathogenic ticks are able to get on the beast and feed.

Before the spread of East Coast fever there was no available specific evidence regarding the action of dips on cattle and ticks when used at short intervals. From our work at Gonubie Park we knew that it was possible to eradicate every variety of tick by means of a fortnightly interval, provided the dip would kill every tick present on the animal at the time of dipping, but with East Coast fever approaching eradicating ticks by dipping at such an interval would prove far too long a process to be recommended. The object of the farmer must be to kill off as many of the ticks as possible by means of five-day dippings, and then if an outbreak actually occurs on his farm he should reduce this interval to such a length that the feeding of any pathogenic ticks is prevented, and hence the disease is stamped out entirely.

These experiments were undertaken in March, 1910, to ascertain what strength of dip is required, its effect on the cattle, and at what interval it must be used in order to prevent ticks from feeding on the dipped animals. If the ticks can be prevented from feeding then East Coast fever can be stamped out.

The results were not published at the time, as they did not appear to the writer to be of sufficient interest to the general public to warrant their publication, but seeing that, in spite of short interval dipping, East Coast fever has been spread considerably, owing in some cases probably to lack of knowledge in regard to the strength of dip required, the publication at the present stage of any work which is likely to throw more light on the subject will probably be appreciated.

There were no pathogenic ticks available for these experiments, so it was impossible to carry out the work of stamping out the disease after any outbreak had occurred on the farm. The only possible method was to ascertain what interval between dipping and what strength of dip was required in order to keep the cattle free of ticks without causing them any injury. If they could be kept free from ticks whilst running on the heavily infested pasturage then they can be kept free from East Coast fever.

EXPERIMENTAL DETAILS.

Strength of Dip.—For these experiments Cooper's Cattle Dip was used at two different strengths, namely, 1-150 (arsenious oxide 1 part, 600 parts water), and 1-200 (arsenious oxide 1 part. water 800 parts).

Interval.—One lot of cattle was treated every four days at 1-200, another lot every five days at 1-200, and the third lot every five days at 1-150.

The Cattle.—Three head of cattle were selected for each of these sets of experiments. All of them were well infested with ticks at the beginning of the experiments. They were of a varied character, the majority of them being long haired and soft skinned, the variety most likely to be scalded when treated with an arsenical dip.

During the experiment they were run in a small double-fenced paddock, the fences 7 feet apart, which was used as a place for breeding ticks. This paddock had been artificially infested with seed ticks on several different occasions, with the result that any cattle which were allowed to run there for more than a few days became very heavily infested with ticks.

In fact the paddock was used for running cattle which were required for experimental purposes to be heavily infested with every variety of ticks. Throughout the whole period of these experiments infestation in this paddock was maintained by allowing undipped cattle to run there alongside the experimental cattle; thus the work was done under the worst conditions possible.

The cattle were all in moderate condition, but owing to insufficient grazing in the paddock they were unable to maintain their condition throughout the whole period. At no time was there any purging or blowing to be noticed, nor were their skins affected by the dip.

Application of Dip.—The method of application of the dip was by hand spraying, which was conducted in a kraal within the paddock. Throughout the period of the experiment the cattle were never allowed to go outside the paddock.

Before being sprayed, each beast was thoroughly overhauled and all living ticks noted; afterwards observations were made regarding the general effect of the dip on the animals.

The cattle were sprayed twenty times in all.

The Ticks.—As a rule all the brown and red ticks were killed at each spraying. After the second spraying no adult blue ticks were

seen at all. About 50 per cent. of the male bonts and a few of the female bonts were killed at each spraying.

It was found, however, that some of these remained on the hosts throughout several sprayings without changing in size appreciably, being unable to engorge themselves owing to the effects of the dip. In one instance, Animal No. 0210, two female bonts stayed on throughout the whole series of experiments—ninety-four days. No tick of any species engorged itself during the period.

EXPERIMENT 1.

Twenty sprayings, every five days, with Cooper's Cattle Dip, at 1-150 (arsenious oxide one part, water 600 parts).

Beast No. 0210.—Red Shorthorn.

(Sprayed 31st March, 1910.)

Date when Sprayed and Examined.		Result of Examination.
5th April, 1910	...	Reds and browns all dead; most of the bonts alive.
10th April, 1910	...	One live red under tail.
15th April, 1910	...	Only ticks alive are bonts and only a few of these remain on.
20th April, 1910	...	Two live reds under tail; several bonts between legs.
25th April, 1910	...	Three live reds under tail; two browns between legs; eight bonts (female) between legs.
30th April, 1910	...	Seven bonts alive.
5th May, 1910	...	Seven bonts alive; three reds under tail.
10th May, 1910	...	Four female bonts alive.
15th May, 1910	...	Five female bonts.
20th May, 1910	...	Two female bonts between legs (these bonts have been on since 31st March); two small nymphal red ticks in ear.
25th May, 1910	...	Two reds under tail; nymphal reds in ears; two male and two female bonts.
30th May, 1910	...	Five reds under tail; one brown between legs; three female bonts between legs.
4th June, 1910	...	Three males, two female bonts between legs.
9th June, 1910	...	One red under tail; three female, five male bonts between legs.
14th June, 1910	...	Two female, six male bonts between legs.
19th June, 1910	...	Two female, six male bonts between legs.
24th June, 1910	...	Two female bonts between legs.
4th July, 1910	...	Five male, three female bonts, two reds under tail.

Beast No. 1330.

(Sprayed 31st March, 1910.)

5th April, 1910	...	Reds and browns all dead.
10th April, 1910	...	One live blue on left thigh.
15th April, 1910	...	Two live reds under tail.
20th April, 1910	...	One live blue on left thigh; one female, three male bonts alive.
25th April, 1910	...	One red and three bonts under tail.
30th April, 1910	...	Nothing alive.
5th May, 1910	...	One male bont alive.
10th May, 1910	...	One live male bont.

Date when Sprayed and Examined.		Result of Examination.
15th May, 1910	...	Two reds under tail; one male bont.
20th May, 1910	...	Two reds under tail.
25th May, 1910	...	Two reds under tail; one male bont between legs.
30th May, 1910	...	Three reds under tail.
4th June, 1910	...	No ticks.
9th June, 1910	...	No ticks.
14th June, 1910	...	One red under tail.
19th June, 1910	...	No ticks.
24th June, 1910	...	Two reds under tail.
29th June, 1910	...	No ticks.
4th July, 1910	...	One red under tail.

Beast No. 2011.

(Sprayed 31st March, 1910.)

5th April, 1910	...	Reds and browns dead.
10th April, 1910	...	One live red on right dewlap.
15th April, 1910	...	All dead except bont.
20th April, 1910	...	Two females, six male bonts alive; one live red under tail.
25th April, 1910	...	Two reds under tail; two bonts alive.
30th April, 1910	...	Two reds alive under tail: three bonts alive.
5th May, 1910	...	Two bonts alive; one red under tail.
10th May, 1910	...	Two bonts alive.
15th May, 1910	...	One female bont.
20th May, 1910	...	Nymphs in ears.
25th May, 1910	...	One male bont on shoulder; one red under tail; nymphs in ears.
30th May, 1910	...	Not a live tick.
4th June, 1910	...	One red under tail.
9th June, 1910	...	No ticks.
14th June, 1910	...	No ticks.
19th June, 1910	...	One red under tail.
24th June, 1910	...	No ticks.
29th June, 1910	...	No ticks.
4th July, 1910	...	No ticks.

EXPERIMENT 2.

Twenty sprayings, every five days, with Cooper's Cattle Dip, at 1–200 (arsenious oxide one part, water 800 parts).

Beast No. 3030.

(Sprayed 23rd May, 1910.)

Date when Sprayed and Examined.		Result of Examination.
28th May, 1910	...	Three live blues; one red under tail; two male bonts; several browns in brush.
2nd June, 1910	...	One male bont under tail, one between legs.
7th June, 1910	...	One red under tail.
12th June, 1910	...	One red under tail.
17th June, 1910	...	One red under tail.
22nd June, 1910	...	One red under tail.
27th June, 1910	...	Not examined.

Date when Sprayed and Examined.		Result of Examination.
2nd July, 1910	...	No ticks.
7th July, 1910	...	One red under tail.
12th July, 1910	...	No ticks.
17th July, 1910	...	No ticks.
22nd July, 1910	...	No ticks.
27th July, 1910	...	No ticks.
1st August, 1910	...	No ticks.
6th August, 1910	...	One red under tail.
11th August, 1910	...	Two reds, one male bont under tail.
16th August, 1910	...	One red under tail.
21st August, 1910	...	Three reds under tail.
26th August, 1910	...	Three reds under tail, one male bont on escutcheon.
31st August, 1910	...	Two reds under tail, one male bont on escutcheon.

Beast No. 0030.

(Sprayed 23rd May, 1910.)

28th May, 1910	...	One male bont under tail.
2nd June, 1910	...	No ticks.
7th June, 1910	...	Two reds, one male bont under tail.
12th June, 1910	...	One red under tail.
17th June, 1910	...	No ticks.
22nd June, 1910	...	One red under tail.
27th June, 1910	...	Too dark to examine.
2nd July, 1910	...	No ticks.
7th July, 1910	...	One male bont on escutcheon; one red under tail.
12th July, 1910	...	One male bont on escutcheon; one male bont between legs; one red under tail.
17th July, 1910	...	One male bont between legs.
22nd July, 1910	...	One red, one male bont under tail.
27th July, 1910	...	Three reds under tail.
1st August, 1910	...	One male bont between legs; one red under tail.
6th August, 1910	...	One male bont between legs.
11th August, 1910	...	One male bont between legs.
16th August, 1910	...	No ticks.
21st August, 1910	...	Four reds under tail.
26th August, 1910	...	Three reds under tail.
31st August, 1910	...	One red under tail.

Beast No. 2101.

(Sprayed 23rd May, 1910.)

A few male bonts between hind legs, several brown on ears and in brush.

28th May, 1910	...	One blue on scrotum; two reds under tail; one female and two bonts (male) between hind legs; ears full of nymphal reds.
2nd June, 1910	...	One male bont between legs, four under tail.
7th June, 1910	...	No ticks.
12th June, 1910	...	No ticks.
17th June, 1910	...	One male bont under tail.
22nd June, 1910	...	No ticks.
27th June, 1910	...	Not examined.
2nd July, 1919	...	No ticks.

Date when Sprayed and Examined.		Result of Examination.
7th July, 1910	...	No ticks.
12th July, 1910	...	No ticks.
17th July, 1910	...	No ticks.
22nd July, 1910	...	No ticks.
27th July, 1910	...	No ticks.
1st August, 1910	...	No ticks.
6th August, 1910	...	One male bont between legs; one red under tail.
11th August, 1910	...	Two reds under tail.
16th August, 1910	...	No ticks.
21st August, 1910	...	No ticks.
26th August, 1910	...	No ticks.
31st August, 1910	...	Three reds under tail.

EXPERIMENT 3.

Twenty sprayings, every four days, with Cooper's Cattle Dip, at 1–200 (arsenious oxide one part, water 800 parts).

Beast No. 1111.

(Sprayed 31st March, 1910.)

Well infested, particularly in ears, under tail and in brush.

Date when Sprayed and Examined.		Result of Examination.
4th April, 1910	...	No live reds or browns; some of male bonts dead.
8th April, 1910	...	Only living ticks were two male bonts.
12th April, 1910	...	Four reds under tail alive and three male bonts between hind legs.
16th April, 1910	...	One male bont between legs.
20th April, 1910	...	One live bont (male).
24th April, 1910	...	One red; three male bonts.
28th April, 1910	...	Nothing alive.
2nd May, 1910	...	One male bont and three reds.
6th May, 1910	...	One red under tail.
10th May, 1910	...	No live ticks.
14th May, 1910	...	No live ticks.
19th May, 1910	...	Two reds under tail.
23rd May, 1910	...	Two reds under tail; few nymphs in ears.
27th May, 1910	...	No ticks.
30th May, 1910	...	One red under tail.
3rd June, 1910	...	No ticks.
7th June, 1910	...	Two reds under tail.
11th June, 1910	...	One red under tail.
15th June, 1910	...	No ticks.

Beast No. 0011.

(Sprayed 31st March, 1910.)

4th April, 1910	...	Browns and reds dead; some of male bonts dead.
8th April, 1910	...	One female and four male bonts alive.
12th April, 1910	...	One male on scrotum and one on penis alive.
16th April, 1910	...	One male bont alive between legs.
20th April, 1910	...	One male bont alive on scrotum; three reds under tail.

Date when Sprayed and Examined.		Result of Examination.
24th April, 1910	...	One live red under tail.
28th April, 1910	...	Nothing alive.
2nd May, 1910	...	Nothing alive.
6th May, 1910	...	Not a live tick; beast looks sick and gave much trouble by lying down and refusing to rise.
10th May, 1910	...	Two reds under tail; some nymphal browns in hollows of ears.
14th May, 1910	...	Not a live tick.
19th May, 1910	...	Not a live tick.
23rd May, 1910	...	One red under tail.
27th May, 1910	...	No ticks.
30th May, 1910	...	No ticks.
3rd June, 1910	...	No ticks.
7th June, 1910	...	One red on escutcheon.
11th June, 1910	...	No ticks.
15th June, 1910	...	No ticks.

Beast No. 2100.
(Sprayed 31st March, 1910.)

Brown and white; blind.

4th April, 1910	...	Browns and reds dead, a few left in brush; some of male bonts dead.
8th April, 1910	...	Few bonts still alive.
12th April, 1910	...	No ticks alive except one red under tail.
16th April, 1910	...	Three male bonts alive.
20th April, 1910	...	One male bont alive.
24th April, 1910	...	Nothing alive.
28th April, 1910	...	Nothing alive.
2nd May, 1910	...	Nothing alive.
6th May, 1910	...	Not a live tick on the beast.
10th May, 1910	...	One red under tail.
14th May, 1910	...	One red under tail.
19th May, 1910	...	One red under tail.
23rd May, 1910	...	Not a live tick.
27th May, 1910	...	Nymphs in ears.
30th May, 1910	...	No ticks.
3rd June, 1910	...	No ticks.
7th June, 1910	...	No ticks.
11th June, 1910	...	No ticks.
15th June, 1910	...	No ticks.

CONCLUSIONS.

The conclusions to be drawn from these experiments are that it is possible to spray or dip cattle every four days with an emulsion containing arsenious oxide in the proportion 1 to 800 without causing any injury to the cattle, and it is also possible to spray or dip cattle every five days with an emulsion containing arsenious oxide in the proportion of 1 part emulsion to 600 parts water without any ill-effects whatever.

Further, with four-day spraying cattle can be kept practically free of ticks, although they may be running on grossly infested pasturage alongside non-dipped heavily infested cattle which are kept there to maintain the infestation of the paddock.

Spraying at the five days' interval gave satisfactory results with the stronger of the two solutions (Experiment 2), but was not so satisfactory with the weaker dip (Experiment 1).

It must be remembered, however, that the conditions under which these experiments were done were made as bad as possible by artificial infestation of the paddock and by keeping heavily infested cattle undipped in the paddock before the experiment started, and then throughout the period whilst the work was proceeding.

Such conditions are never met with under ordinary circumstances. No farmer would infest his veld with seed ticks, nor with pathogenic nymphs or adults, then allow undipped cattle to run in the same camp with cattle being dipped every four or five days.

In view of the abnormal conditions of the experiment it is reasonable to conclude that under ordinary circumstances East Coast fever can be stamped out by treating the cattle every five days, and in any case the interval need never be shorter than four days.

It is worthy of note that all the East Coast fever ticks found on the cattle after the first two sprayings were either in the ears or under the tail; to both these places a hand-dressing substance can be readily applied.

Treatment of this nature, in addition to four or five day dippings, would reduce the possibility of East Coast fever spreading to a minimum.

The most practical advice one can offer as a result of experience gained with these experiments and other field work is—dip every five days in an emulsion dip containing arsenious oxide in the proportion of 1 part to 800 parts of water when East Coast fever threatens; then if an outbreak occurs amongst the cattle reduce the interval between dippings to four days, but do not reduce the strength of the dip.

The Production of Bright Tobacco by the Flue and Air Curing Processes.

By H. W. TAYLOR, B.Agr., Officer in Charge, Rustenburg Experimental Station, of the Tobacco and Cotton Division, Pretoria.

TOBACCO cultivation in the Union of South Africa is rapidly developing into an extensive and profitable industry. The individual planters in the older tobacco-producing districts, Rustenburg, Piet Retief, and Kat River, are increasing their acreage devoted to this crop, and in addition companies are being formed to promote the industry. New areas, such as the Turkish-producing region in the Cape Province and in the Vredefort District of the Orange Free State, have already attained such prominence that they must now be included in the large tobacco-producing districts. Potchefstroom and Zoutpansberg Districts are also producing considerable quantities of "yellow" and "light red" leaf, so that they will, when their acreage is increased, be recognized in the market as producers of this class of tobacco.

The grades of local grown tobacco which command the highest prices are "yellow" and "light red" leaf of fine texture, suitable for cigarettes. The demand for these grades is in excess of the supply, and hence fancy prices are paid for tobacco of these classes. It therefore behoves every farmer to produce these classes of leaf wherever possible.

In the past all tobacco produced in the Union of South Africa other than Turkish tobacco has been cured by the air-curing process, but several of the more progressive growers are now adopting the flue-curing method for the production of "light-coloured leaf." That the latter method is practical, and preferable in most cases, has been amply demonstrated by the experiments carried out at the Government Tobacco and Cotton Experiment Station at Rustenburg.

HISTORY OF THE AIR-CURING PROCESS.

By far the greater part of the tobacco crop of the world, perhaps 90 per cent., is cured by this method. When tobacco cultivation was first undertaken by John Rolfe, at Jamestown, Virginia, U.S.A., in 1612, the method of curing consisted merely of harvesting the plants and hanging them in the shade of trees to dry. As the cultivation extended buildings were provided to shelter the crop, and these in turn have been improved from time to time until to-day the air-curing tobacco barns on up-to-date estates in America and other countries are models of the more advanced type of rural architecture. As tobacco cultivation extended to other parts of America and other countries the air-curing process was for the most part methodically adopted, until to-day this method is used in every part of the world where tobacco is produced.

In the more advanced tobacco-producing districts of the United States of America the growers have found that heavy losses are often experienced when they depend upon climatic conditions to cure their crop, and they are therefore adopting one of the several methods of using artificial heat to cure their tobacco or to assist in the curing when climatic conditions are unfavourable.

HISTORY OF THE FLUE-CURING PROCESS.

The process of curing tobacco by means of artificial heat is a comparatively new method. This process had its origin in the State of North Carolina, in the United States of America, about the year 1852, or two hundred and forty years after the tobacco plant was brought under domestication. Artificial heat, regulated in a definite manner, was first used for curing tobacco by two brothers, Eli and Elisha Slade. These men grew tobacco on very light, sandy soil in Caswell County, North Carolina, and by using charcoal fires succeeded in curing their tobacco a beautiful lemon yellow colour. Their neighbours soon began to use the same method, and secured the same results. Improvements in the process were made, and the charcoal fires were superseded by a furnace and flues, by which means the temperature is more easily controlled. The industry was being well established when the Civil War broke out in the States, and between 1860 and 1870 very little flue-cured tobacco was produced. However, the industry was revived about 1870, and the cultivation of "yellow tobacco" spread rapidly. On account of its beautiful colour and pleasing odour and flavour the leaf commanded a very high price. Its cultivation soon spread into South Carolina, Virginia, Tennessee, and Georgia, and in these States hundreds of flue barns were built.

This type of tobacco has become so popular that the demand for it is very great, and from its humble beginning this process has spread beyond the confines of the "yellow tobacco district" in the United States of America, and flue barns are also now found in Asia and Africa.

When tobacco cultivation was introduced into Rhodesia experiments in flue-curing were made. These experiments proved so successful that this method of curing tobacco has been largely responsible for the success of the industry in that rapidly developing country.

In Nyasaland tobacco is being successfully cured in flue-barns, and about 2,000,000 lb. of cured leaf were exported from that Protectorate last season. That the quality of the tobacco is good is shown by the fact that it is regarded by English buyers as an excellent substitute for the best flue-cured tobacco from the States.

After experimenting with this process for three years we are now able to state definitely that where the proper soil exists, and where the climatic conditions are favourable to tobacco production, flue-curing can be successfully and profitably practised in the Union of South Africa.

ADVANTAGES OF THE AIR-CURING PROCESS.

The principal advantages of this process are that it requires less care and a smaller amount of labour than the flue-curing process. Where firewood is scarce the cost of air-curing is also considerably less. However the air-curing process has several disadvantages. With this method of curing the grower is more or less at the mercy of the elements. When climatic conditions are favourable some excellent "light coloured leaf" is produced, but when the weather is unfavourable the growers often sustain heavy losses. We have seen barns of air-cured tobacco in the Transvaal in which fully 80 per cent. of the leaf was either "yellow" or "light red," and we have also seen in the same season adjoining barns of tobacco, which had been

Plate No. LXVIII.

TOBACCO AIR-CURING BARN. RUSTENBURG GOVERNMENT EXPERIMENT STATION.

grown on the same soil and treated in the same way, in which there was practically no yellow leaf, due to unfavourable weather conditions during the curing period. When cool, wet weather prevails for a week or ten days after the tobacco has been harvested, and more especially after the tobacco has "yellowed," although the tobacco be grown on the most suitable soil, it will cure a dark colour more often than "yellow" or "light red." On the other hand, if severely dry and windy weather is experienced immediately after the tobacco is harvested it will dry out too rapidly, and much of the green colour will remain in the leaf, thereby decreasing its value. Of course when closed barns are used much can be done to alleviate these unfavourable conditions. When the weather is too cool and wet for curing to properly proceed, charcoal fires will materially assist the process; and when the weather is very dry the tobacco can be prevented from drying too rapidly by keeping the ground beneath the tobacco thoroughly soaked with water.

ADVANTAGES OF THE FLUE-CURING PROCESS.

The advantages this process has over air-curing are numerous. In the first place, a higher percentage of "yellow" leaf can be obtained—the grade which commands the highest price on the market. Then, flue-cured tobacco has a more pleasing odour and flavour than air-cured tobacco, hence leaf of the same colour will command a higher price when flue-cured. By using artificial heat in a tight shed the tobacco is not subject so much to climatic changes during and after curing; then in a dry climate, such as we have in South Africa, the tobacco which is harvested late in the season and placed in the ordinary air-curing barn must hang until the rains of the following season before it can be prepared for market, unless special provisions are made for moistening it. Being thus exposed to the severe winds considerable loss occurs, and the farmer must wait several months for the money from that portion of his crop. When tobacco is cured in a flue-barn it can be moistened and immediately taken down. This process will be explained later. More tobacco can be cured in a flue-barn than in a barn of any other type which costs the same amount of money.

CURING BARNS.

Air-curing Barns—

Air-curing barns used in South Africa can be divided into three types according to the material used in their construction. The three types are brick, corrugated iron, and grass. It would be difficult to say at the present time which type is preferable, since the three types have not, to our knowledge, been tried on the same farm and at the same time. The general opinion amongst practical growers is that the iron barns are preferable to those with thatched roofs.

Whatever type of barn is used it should be located in a well-sheltered place, so that the tobacco will not be influenced by strong winds while curing, and also that the dry tobacco may not be damaged while hanging in the barn.

Brick Barns—

A good type of brick barn is shown in Plate LXVIII. This barn is 60 feet long and 20 feet wide. This makes the barn five tiers in width, and it is also five tiers in height, the bottom tier being 5 feet from the ground and the remaining tiers 2 feet 9 inches apart vertically. Horizontally the tiers are 4 feet apart. The sides of the barn are

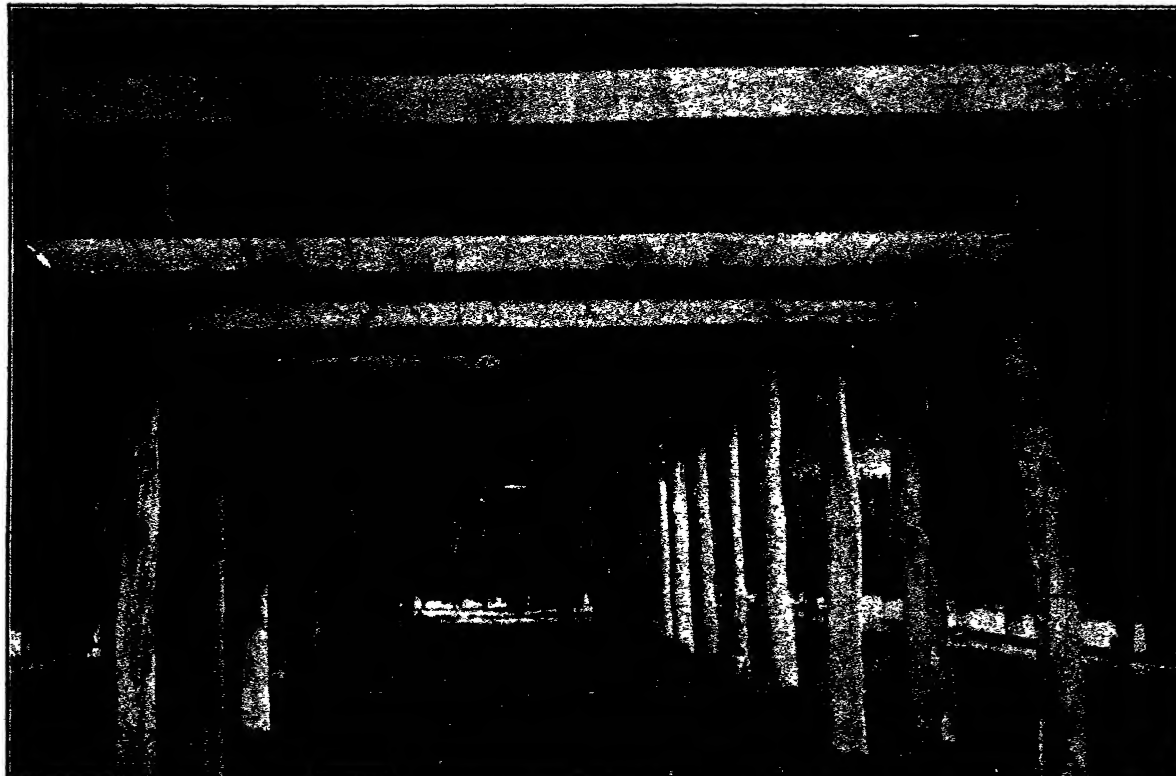


Plate No. LXIX. INTERIOR OF CORRUGATED IRON BARN.

The tobacco is attached to the barbed wires either by a sloping cut in the stalk near the base, or by tying grass around the base of the stalk and attaching the grass to the barb of the wire

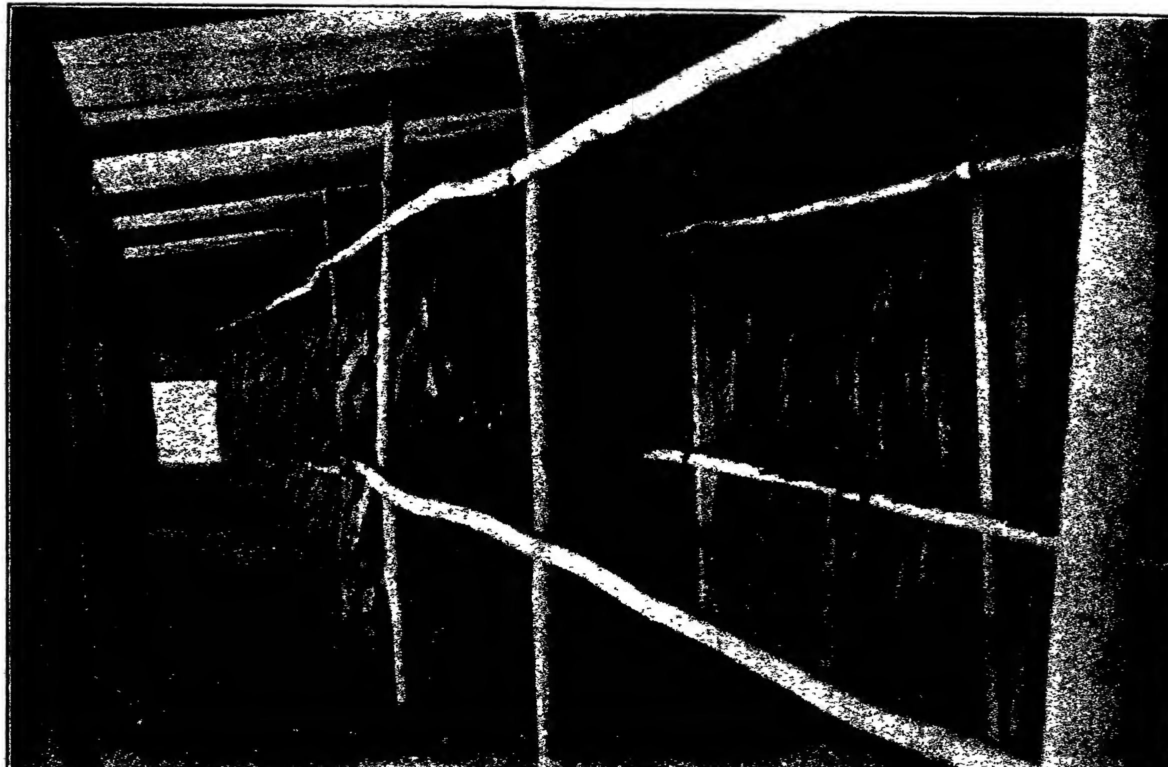


Plate No. LXX.

INTERIOR OF CORRUGATED IRON BARN.
Showing use of laths for supporting the tobacco

fitted with ventilators which can be opened and closed at will, and a ventilator is also fitted into each end of the barn near the top so that the building can be thoroughly ventilated. Entrance is made into the barn by double sliding doors at each end. The tier poles are 3 inch by 4½ inch deals, but they could be made of poplar poles. The tier poles are supported at intervals of 12 feet by 4 inch by 4 inch deals. The roof principals are 1½ inch by 4½ inch deals, and the purlins are 3 inch by 2¼ inch. The walls are of burned brick, and are 14 inches, or one and a half bricks, thickness, and are supported by a stone foundation. This barn gives excellent results in dry seasons, but during wet seasons, unless charcoal fires are used, the tobacco cures too slowly and the leaf is therefore dark. The capacity of this barn is about 24,000 plants.

Corrugated Iron Barns—

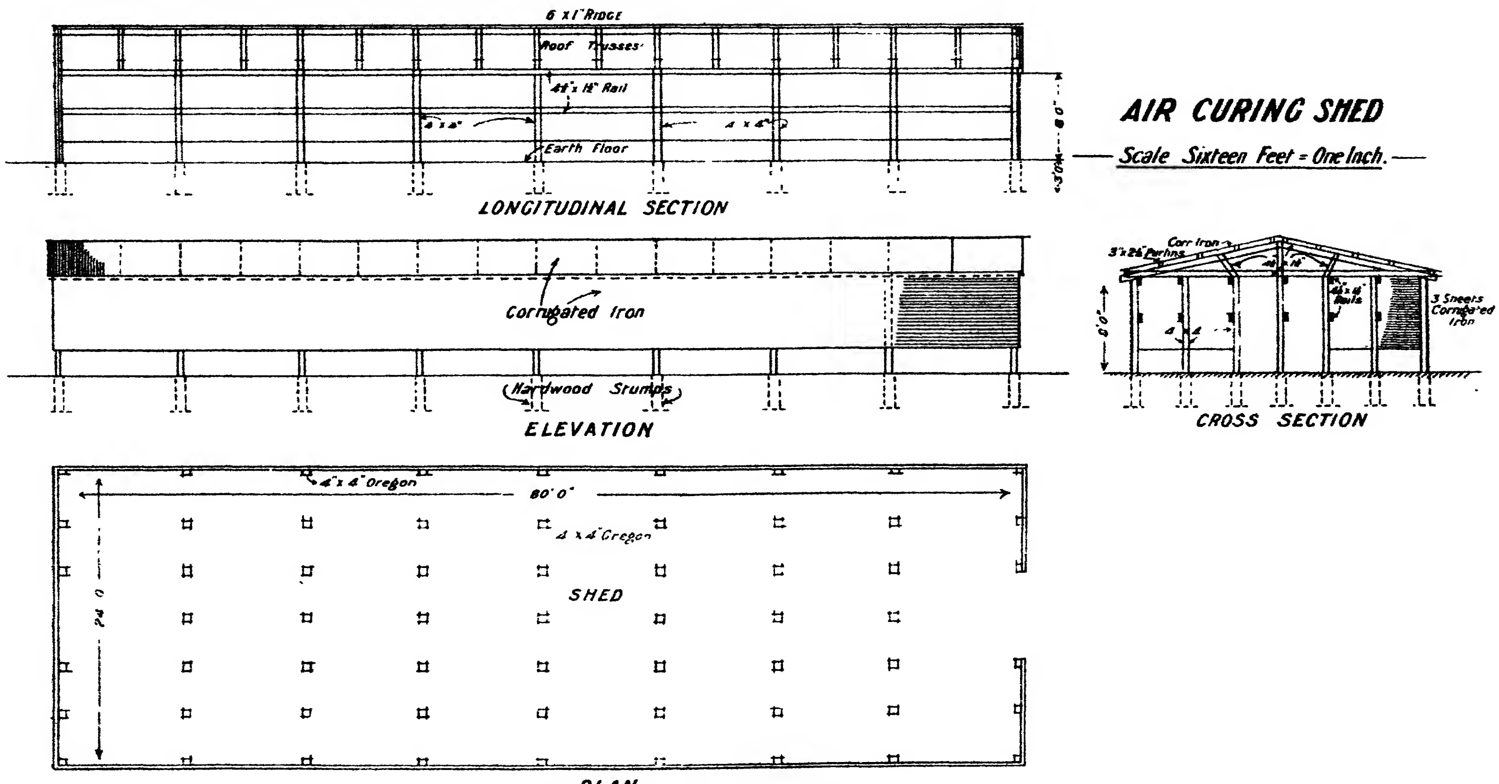
Corrugated iron barns should be from 24 feet to 28 feet in width, and can be made any length which is most convenient to the grower. On most farms these barns are only a single tier in height and are so constructed that the tobacco is hung on wires placed lengthwise of the building. The tobacco is attached to the wire either by a sloping cut in the stalk near the base or by tying grass around the base of the stalk and attaching the grass to the barb of the wire (Plate LXIX). This method has one advantage in that the tobacco can be hung very closely, and hence little space is lost; but it also has a serious disadvantage in that the tobacco cannot, when dry, be moved into a closed room for steaming. A better type of corrugated iron barn is shown in the accompanying sketches. A barn of this type provides for two tiers vertically and six to seven tiers horizontally. The bottom tier is 5 feet from the ground and the second tier 3 feet above the first. The tiers are 4 feet apart horizontally. The tier poles can be made either of deals or poplar poles. The roof is made of corrugated iron. The roof principals are 1½ inch by 4½ inch deals, with 3 inch by 2¼ inch purlins. The sides and ends should be enclosed with corrugated iron or reeds to prevent the tobacco from being damaged by strong winds. A shed of this type—100 feet long and 28 feet in width—will have a capacity of about 30,000 plants. The type of shed is well adapted for curing light coloured leaf in an average season, but during severely dry, hot, and windy weather the tobacco often dries too rapidly; and when cured the leaf has a greenish colour, which reduces its value. This barn also provides for the use of laths or reeds for supporting the plants (Plate LXX), and they can therefore be easily transferred to a pit for moistening or to a closed room for steaming.

Grass Barns—

Grass barns should be built on the same principle as the corrugated iron barns, but the roof will require greater pitch in order to carry off the rain-water (Plate LXXI). The higher roof will, however, give the barn greater capacity, as additional tiers can be placed above those shown in the plan for the corrugated iron barn. In dry weather this type of barn gives good results, but when the weather is cool and moist the tobacco dries too slowly, and hence cures a dark colour.

FLUE-CURING BARNS.

Flue-curing barns are built small. The best size is 16 feet square (inside measurements) by 20 feet high. We are often asked why the



PLAN OF CORRUGATED IRON AIR CURING SHED.

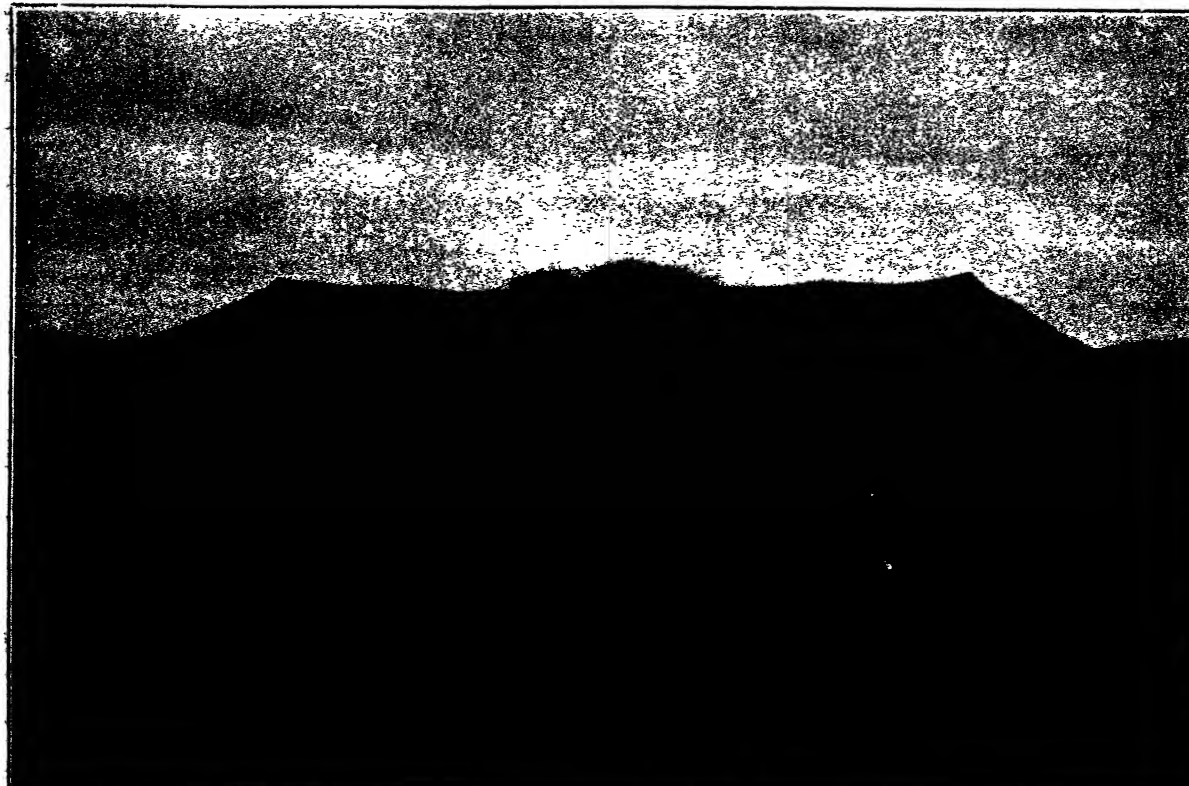
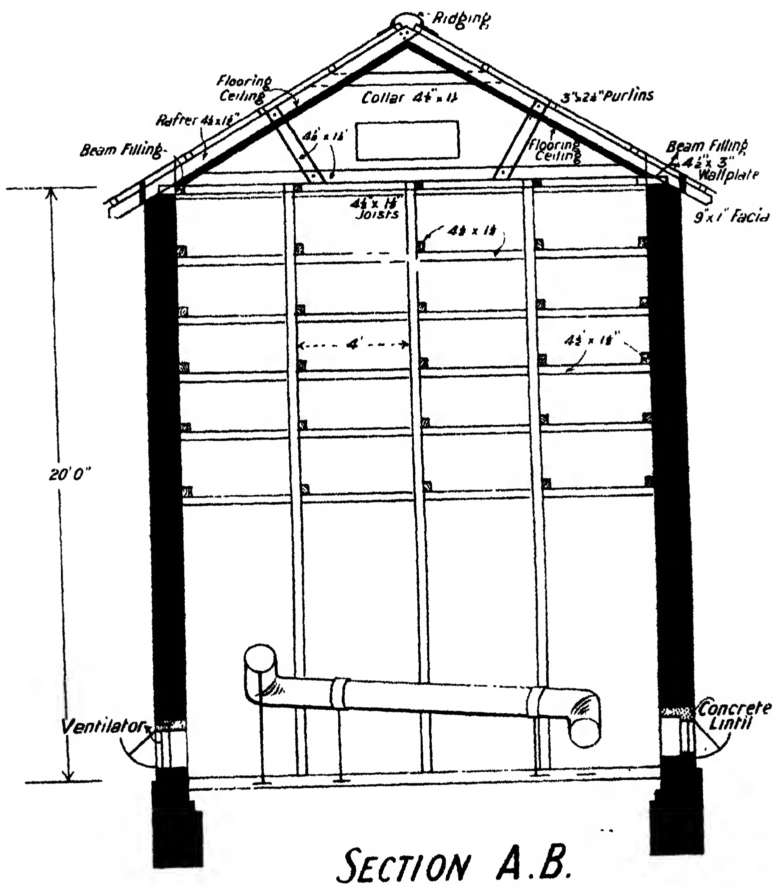


Plate No. LXXI. TYPE OF GRASS BARN.

barns are not built larger. The reason is that the shed must be filled in one day, and a barn of the above dimensions can be readily filled in one day by the labour found on the average farm. Again, tobacco cures a more uniform colour in a small barn than in a large one, as it is much easier to maintain a uniform heat.

The width of a curing barn should always be some number of feet which is divisible by four, allowing space for the tier poles, since

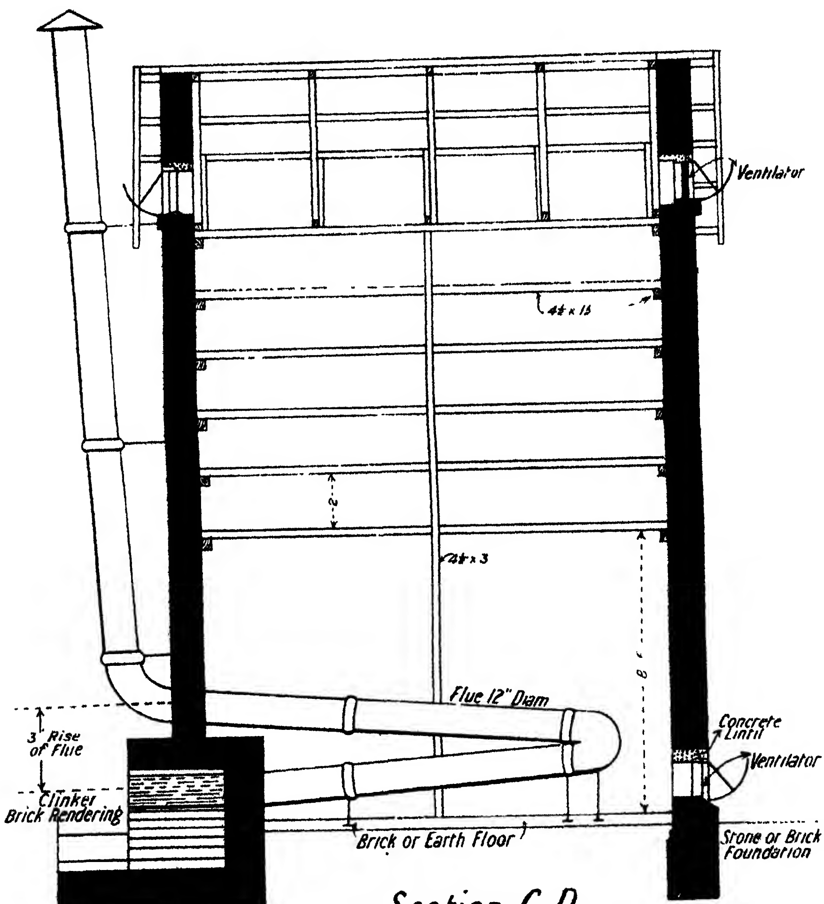


CORRUGATED IRON BARN.

the tier poles—upon which are placed the laths carrying the tobacco leaves—are placed 4 feet apart. A barn of the above dimensions would be divided into four rooms, each of which should contain six tiers, thus making twenty-four tiers in the barn each 16 feet long. A "tier" is the horizontal space between two tier poles or deals, and a "room" is the vertical space included between two sets of tier poles extending from the bottom to the top of the barn. A barn 16 feet square inside and 20 feet high may be described as a four-room or twenty-four tier barn. When filled, a barn of the above size will hold about as much tobacco as can be grown on one-half of an acre. The

barn can be filled three times each month, so that about one and one-half acres of tobacco can be cured in each barn per month.

The first set of tiers is placed 9 feet from the floor. This height is necessary to prevent the leaves in the lower tiers from being injured by high temperatures. The remaining tiers are placed 24 inches apart vertically (see Section CD of plan). All tiers are placed 4 feet apart horizontally (see Section AB of plan).

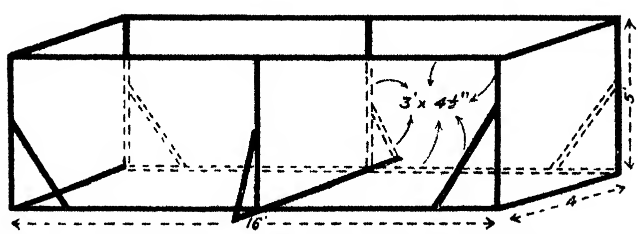


Section C.D.

CORRUGATED IRON BARN.

The tier poles may be made of 2 inch by 4 inch deals or round poplar poles. The three inside sets of tier poles are supported in the middle by 3 inch by 4½ inch deals or by large poplar poles. The ends of the tier poles are supported by ½ inch by 4½ inch deals secured to the end walls or are built into the end walls. The outside sets of tier poles are supported by being attached to the walls (see Section AB of plan). The walls are built of brick, and are 14 inches, or one and a half bricks, thick. The outer course of brick should be well burned, but the inner

course can be constructed from ordinary sun-dried brick. Near the ground, on three sides, two ventilators 12 inch by 18 inch should be placed in each wall (see Ground Plan). Also a ventilator 18 inches by 42 inches should be placed in each end of the barn above the top tier (see Section CD of plan). All of these ventilators should be so constructed that when closed very little air will enter the barn and no moisture escape. The door should be made in two parts (elevation plan) and as small as convenient, and should also be tight fitting. The roof principals should be made of 1½ inch by 4½ inch material (see Section AB of plan). The roof is made of corrugated iron and lined inside with flooring boards to make it as nearly air-tight as possible (see Section AB of plan). The furnace should be 5 feet long, 2 feet 6 inches wide, and 2 feet 9 inches high (inside dimensions). Only about 18 inches of the furnace should project outside the walls. It should be well arched, and unless fire-brick are used in its construction the arch should have some support. Old wagon tyres make excellent supports. The flue (ground plan) should be 12 inches in diameter. The first 8 or 9 feet should be of ⅛ inch material to withstand the high temperature, and the remainder of the material can be 22-inch gauge sheet-iron. The flue extends around



CORRUGATED IRON BARN (longitudinal section).

the inside of the barn about 2 feet from the wall, and the point at which it passes out of the wall should be about 3 feet higher than the point at which it is set into the furnace (see Section CD of plan). The mouth of the flue should be about 2 feet above the floor of the furnace to prevent the draught from being affected by charcoal forming a bank in front of the flue-pipe. It is advisable to have the flue-pipe extend above the roof (Section CD of plan) so that the draught will remain constant whatever the direction of the wind.

Where cheap construction is desired the cost of erection can be kept at a very low figure. The only material which it is necessary to purchase is that used in the roof, door, ventilators, and flue. Straight poplar poles can be used for tier poles and the brick can be made on the farm. The total cost should not exceed £75, including material and erection.

VARIETIES TO GROW FOR AIR-CURING.

The varieties which give the best results are Yellow Pryor (Plate LXXII), Blue Pryor, Boyd 1269 (Plate LXXIII), White Burley, Joiner, and Swazi. The objection to Swazi is that the leaf is very narrow, which is undesirable from the manufacturer's point of view. White Burley is very delicate, and it is difficult to get the young plants established, but the quality of the leaf is excellent.

Plate No. LXXII. A FIELD OF "YELLOW PRYOR."

Plate No. LXVIII.

A Field of "Boyd 1269."

VARIETIES TO GROW FOR FLUE-CURING.

Yellow Pryor, Blue Pryor, Boyd 1269, Bullion, and Hester are the varieties which give the best flue-cured leaf.

SELECTION AND CARE OF SEED PLANTS.

Seed Selection—

The first step in profitable tobacco growing is the securing of good seed. The best results are obtained by the growers who carefully select and properly care for their own seed plants. The custom of securing seed from a different locality each year, or every few years, is wrong both in theory and practice, and is not advised unless the grower prefers to depend on some reliable and more careful individual to perform this important work for him.

When a variety is grown in a locality for the first time it frequently tends to change from the original type and shows divers variations. However, some of the plants will remain true to type, and these plants should be selected for seed. After growing the varieties for a few years the plants will become accustomed to their new environment, and will thereafter breed true if the flowers are protected from cross-fertilization.

To the grower who aims at producing light coloured leaf seed selection is doubly important. Tobacco does not cure a uniform light colour unless it takes on a greenish-yellow colour in the field. Plants of a dark colour in the field usually cure a dark colour, and hence should be avoided. Growers of light coloured leaf, especially if it is to be flue-cured, should save for seed only those plants which show a tendency to "yellow" on the land. The leaf of the seed plants should be of good length and good width, with fine veins and midrib. The leaves should be close together on the stalk and should not droop or hang on the ground.

Having selected his ideal plants for seed the grower should take steps to see that these plants are not cross-fertilized. Cross-fertilization can be prevented by covering the seed head with a 12-lb. paper bag (Plate LXXIII). The plant should be bagged before any of the flowers open, and should any have opened before the bag is applied they should be pruned off. In preparing the plant for the reception of the paper bag all of the top leaves and sucker branches up to the "crow foot" should be broken off, leaving only three or four top branches to form seed, and only fourteen to sixteen leaves on the stalk. The bag should then be inverted over the flower head and tied loosely with a soft string. When a majority of the pods have formed, say, seventy to eighty, the bag may be removed and the remainder of the flowers or buds pinched off. After removing the bag the plant should be visited weekly to remove any flowers or buds which may have formed. In each well-developed seed pod there are about 5000 seeds, so that each seed head of eighty pods would develop 400,000 seeds. Thus it can be seen that a few seed plants properly cared for will produce sufficient seed for a very large grower.

The seed head should not be severed from the stalk until the pods are brown. Then the seed heads should be taken off and hung in a dry place for several weeks where birds and mice cannot get at them; after this the seed may be shelled out, carefully labelled, and stored in a safe dry place. Before sowing, the seed should be passed through

a tobacco seed-grader to separate the light ones from the heavy ones—only the heavy seed should be sown.

Both experimental and practical results have shown that tobacco grown from properly graded seed is more uniform as to size and colour and that the yield per acre is larger. The Tobacco and Cotton Division of the Union Department of Agriculture is prepared to grade tobacco seed for farmers and return them free of charge.

SEED BEDS.

The greatest care should be exercised in the preparation and management ot the seed beds. Failure to properly prepare and intelligently handle his seed beds may be the means of causing the grower great inconvenience at the time of transplanting, and in some cases may mean the failure of a crop through having no plants. All of the seed beds should not be prepared and seeded at the same time, but they should be sown at regular intervals so that the plants will come on in succession throughout the transplanting season.

The best soil for seed beds is a well-drained light sandy loam. The soil should be friable and of good depth so that it can be deeply worked, and also that its moisture-holding capacity will be great. For this district the site selected should be well protected, and should if possible have an eastern and northern exposure so that the young plants will receive the maximum amount of sunlight. Unless the soil is very fertile the seed beds should receive a liberal application ot kraal manure or commercial fertilizer. Kraal manure is usually at hand, and is more often used.

The following method of preparing seed beds gives excellent results. Remove all rubbish from the surface of the soil where the seed beds are to be made, and if the soil is moist enough to spade up cover to the depth of about two inches with well-pulverized manure. If the soil is very dry and hard it is better to first irrigate the land and then apply the manure. After spreading the manure dig over the soil to the depth of a spade, taking care to thoroughly mix the manure with the soil. The soil should then be finely pulverized with a hand rake and covered with sufficient material to burn it to a depth of 4 to 5 inches. The material used for burning the soil may be brushwood, cotton stalks, or dry mealie stalks. By this sterilization the weed and grass seed in the ground are destroyed, as are also any insects; moreover, burning the soil renders the plant food contained therein more available. After burning rake off all of the charcoal, and again dig over the seed bed to the depth of three inches, turning under all ashes. The beds should then be enclosed with flooring boards or bricks or by banking up the earth at the sides and ends.

Finely pulverize and level the soil, thus making the bed ready for sowing. If the seeds are sown at the rate of 1 oz. to every 120 square yards the plants will be quite thick on the bed (Plate LXXIV). For a bed 3 feet by 25 feet, which is the usual size in South Africa, one half teaspoonful of tobacco seed is ample. In order to secure an even distribution of the seed they should be mixed with wood ashes or mealie meal. The former is less expensive and answers the purpose equally well. After sowing sift enough clean sand over the bed to cover the ashes or mealie meal, and then firm the soil well with a plastering trowel or piece of board. Firming the soil helps to cover the seed and renders the soil more retentive of moisture. As soon as

Plate No. LXXIV. TOBACCO SEED BEDS.

the seeds are sown the beds should be thoroughly watered with a sprinkling can. Seed beds should not be watered by irrigation. After the first watering the seed beds should not be allowed to become entirely dry. On the other hand they should never be entirely saturated with water. Moist, but not wet, is the proper condition.

After sowing, the seed beds should be covered with grass mats or tobacco cheese cloth to hasten germination and also to protect the young seedlings from the hot sun during the day and cold and frost at night. When the plants are well up they should be exposed to the sun for a short time each day. The period of exposure should be gradually increased as the plants grow larger, and when they are sufficiently hardened to stand the hot sun protection is no longer necessary.

SUITABLE SOILS IN THE FIELD.

Tobacco may be grown on almost any soil, provided it is fertile and the climatic conditions are favourable, but the various types of tobacco must be grown on soils suited for the class of leaf desired in order to make tobacco growing a profitable industry. For the production of "yellow" and "light red" leaf the soils which give the best results are black turf, sandy or broken turf, red sandy loams, and sandy soils, light in both colour and texture. Not all turf soils are suitable for the production of light coloured leaf. The black turf which shows an admixture of small white calcareous gravel, and is underlain with the same, is excellent for the production of bright tobacco. The tobacco does not grow large on such soils, but yellows well on the land. Turf soil should have sufficient slope to provide surface drainage in order that surplus water will not stand on the land and drown the plants. Unless the turf soil is well drained it has a tendency to be "brack," and tobacco produced on such soil is poor as regards burning quality.

The sandy soils suitable for bright leaf are greyish in colour, about 14 inches to 16 inches deep and are underlain with a sub-soil of clay and gravel. This type of soil, though very limited in the Transvaal, is very poor in plant food and requires judicious manuring or fertilizing in order to produce a profitable yield.

PREPARATION OF THE SOIL.

Tobacco lands should be properly prepared before transplanting. Thorough preparation of the soil before transplanting enables the young plants to strike root quicker, thus a better stand is secured. Thorough preparation also saves considerable intertillage. When possible the land should be ploughed in the fall and reploughed again before transplanting. This helps to rid the soil of insect pests and makes it more friable. In breaking the land, if the depth of soil will permit, it should be turned 10 or 12 inches deep, and care should be taken to see that the plough is set so that all of the soil is broken and no ridges are left between furrows. Deep ploughing enables the root of the plants to penetrate deeper and brings into use a larger amount of plant food, besides increasing the moisture-holding capacity of the soil.

After ploughing, the soil should be finely pulverized with a harrow. When the soil is light and sandy the roller should precede the harrow in order to slightly firm the surface.

SOIL MANAGEMENT.

Since the growth of the tobacco plant is rapid the soil must be kept in a high state of fertility and intensive cultivation practised if the best results are to be obtained. Continuous cropping without the use of green manuring crops and fertilizers will result in depleted or rundown farms. At the present time much of the best tobacco land in the Transvaal is in this condition. Years of careful management will be required to restore these soils to their normal state of fertility. Soil fertility can be restored by two methods—crop rotation and fertilization. In the case of productive soils their fertility can be maintained by rotation and diversification of crops, but with depleted soils fertilization must also be resorted to in the beginning.

In a proper rotation scheme two sets of crops must be grown. One set is known as the money crops and the other as the improvement crops. The former is grown as a source of revenue and the latter is used to maintain the balance of fertility.

The improvement crop should be one of the several legumes, such as velvet beans, soy-beans, cowpeas, or peanuts. Any of these improvement crops will renew the soil by using the atmosphere as a source from which to draw nitrogen which they convert into nitrates. These nitrates are left in the soil when the roots of the plants decay and are used by the succeeding money crops. The roots, stems, and leaves of the improvement crops become incorporated with the soil, and when they decay they add humus to the soil, which improves its mechanical condition and makes it more retentive of moisture. More than one money crop should be grown in the rotation. Different crops require the several elements of plant food in different proportions, so that by a change of crop there is not so much danger of the soil being robbed of any particular element of fertility. Moreover, different crops send their roots to different depths in the soil, and if several crops are grown in the rotation the same zone of soil is not entirely drawn upon for plant food every growing season.

Rotation of crops is also one of the best means of combatting plant disease, insect pests, and noxious weeds.

The particular crops to be grown in the rotation will vary with individual conditions. The rotation which is being practised at this station is as follows:—

First year, tobacco, money crop, fertilized.
Second year, cotton, money crop, not fertilized.
Third year, velvet beans, improvement crop, not fertilized.
Fourth year, mealies, money crop, not fertilized.

In connection with the above rotation, fertilizers should be applied to the tobacco crop. If a heavy application is given, it will only be necessary to fertilize once in four years. The fertilizer applied should be complete, i.e., it should contain nitrogen, phosphoric acid, and potash. If, however, sufficient nitrogen is obtained through the improvement crops, then it will not be necessary to include it in the artificial fertilizer.

The best results are obtained when the several ingredients are purchased separately and mixed on the farm. For tobacco, fertilizers should be applied broadcast. When the fertilizer is applied in the furrow adjacent to the plant much of the plant food is leached out during irrigation, and is carried in the water to the end of the furrow, and in some cases entirely out of the tobacco field.

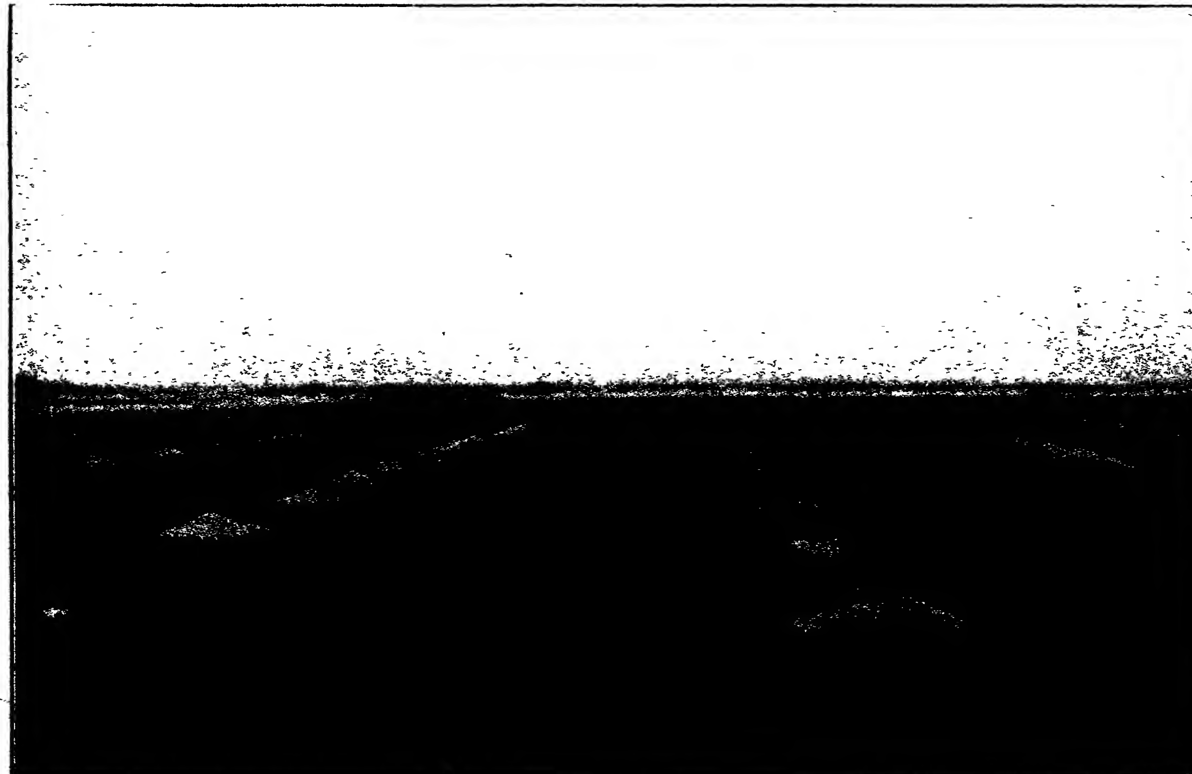


Plate No. LXXV.

MANURING THE LAND.

The best manure for light-coloured leaf is the ash found around old, abandoned Kaffir kraals.

We have found that the following mixture gives good results when used for the production of light-coloured leaf:—

Nitrates of soad, 160 lb.
Sulphate of potash, 200 lb.
Acid phosphate (37 per cent.), 320 lb.

The whole is mixed thoroughly together and applied to one acre. On light, sandy soil, an application of 1000 lb. of lime in addition to the above is very beneficial.

When the grower does not wish to fertilize, manuring will prove equally and in some cases more beneficial. For light-coloured leaf the best manure is the ash found around the old, abandoned Kaffir kraals (Plate LXXV). This ash is usually the residue of the manure which has been burned, and it gives excellent results. The supply is, of course, limited, and will soon become exhausted. When kraal manure is used it should be old, thoroughly decomposed, and well pulverized. Fresh kraal manure has a tendency to produce a coarse, rank growth, which causes the leaf to be dark and heavy when cured.

TRANSPLANTING.

When the plants are about 6 inches in height they are ready for transplanting. For producing light-coloured leaf the rows should be placed 3 feet apart and the plants placed at intervals of 2 feet in the row.

When the slope of the land is such that it can be done, the field should be aligned due east and west. This arrangement allows the sun to shine down between the rows of tobacco during the whole period of growth, and by keeping the surface of the soil dry at the base of the plants helps to prevent "white rust" and other diseases. The field is best marked off by means of a ridging plough. This implement can be so set that the furrow can be made of any desired width and depth, and furthermore the plough can be used generally for making distributing furrows for irrigating orchards and other crops.

When the furrows are made the water should be led into them a short time before the transplanting is done. After the surplus water has soaked into the soil the land is ready for the reception of the plants. Transplanting is best done with a wooden pin about 1½ inches in diameter and 10 inches long.

The pin must be pointed at one end in order to facilitate the operation. The hole for inserting the plant should be made just deep enough to receive the roots of the plant and sufficient of the stem to bring the bud leaves a little above the surface of the soil.

After making the hole with the pin, insert the plant to the proper depth and gently but thoroughly firm the soil about the roots. After transplanting again lead water into the furrow. The second irrigation helps to firm the soil around the roots and facilitates the plants starting under their new conditions. If the season is a favourable one, no further irrigation will be required.

In transplanting, care should be taken to place the roots of the plant straight in the soil. When the roots are placed in the soil in a crumpled mass, the growth of the plant is almost invariably disappointing. If the roots of the plants are too long they should be pruned back until they are only 2 inches to 2½ inches in length to insure their being properly placed in the soil.

When the grower has water for irrigation transplanting can be done during any part or all of the day, but when water is scarce and the plants are watered by hand, the best time for transplanting is in the latter part of the afternoon.

CULTIVATION.

As soon as the plants are well established cultivation should begin. The first operation is the closing of the furrows used for irrigation during transplanting. In this cultivation, hoes or cultivators or both may be used. By filling in the furrow the land is made level and the soil is properly loosened around and between the young plants. If the season is favourable no further irrigation will be necessary, but if a prolonged drought occurs furrows can be made between the rows for the purpose of irrigation. With careful cultivation no hand hoeing will be necessary after the filling in of the original irrigation furrows. No fixed rule can be laid down as to the number of times to cultivate. Cultivation should continue until the plants are so large that they will be damaged by the implements. The best indications that cultivation is necessary are the formation of a hard crust on the surface of the soil and the presence of young weeds; the former indication and often both can be noted after a rain or after the field has been irrigated. Shallow cultivation breaks up the hard crust and destroys young weeds, and should, as a rule, be practised. Just after the last cultivation furrows should be made between the rows so that, if necessary, the field can be irrigated later.

TOPPING.

Topping is removing the terminal bud in order to prevent the plant from forming seed.

To correctly top tobacco, considerable experience and judgment are required. By topping the plants too low the yield can be materially decreased and by topping too high the quality may be impaired. No fixed rule can be given for the exact number of leaves to be left on each plant. Strong, vigorous growing plants will mature more leaves than weaker ones, and tobacco planted on very fertile soil can be topped higher than that planted on poor soil. However, a safe practice it to top the plants at twelve to sixteen leaves.

The tendency among farmers in South Africa is to top too high. When the plants are so topped the top leaves remain small and do not ripen at the same time as do the middle ones, and when harvested, as a rule, cure dark. This increases the percentage of low grade leaf, which means a smaller net profit.

The proper time for topping is when the flower head first appears. The stalk is then young and tender, which facilitates the operation, and the plant food which would have gone into additional leaves and stalk causes the leaves left on the plant to mature more rapidly and more uniformly. Again, when tobacco is topped at the proper height all of the leaves reach maturity more nearly at the same time, and hence the cured product is more uniform.

INSECT PESTS.

The number of species of insects which attack tobacco in South Africa is fewer than in the United States of America, but, nevertheless, their depredations often cause heavy loss.

It is not our intention to go into detail regarding insect pests, but merely to call attention to some of the more important ones, and give simple remedies which have been found effective. In every case where growers are troubled with insects attacking their tobacco, they should at once send specimens to the chief of the Division of Entomology, Pretoria, who is always able to give them valuable advice as to the best methods of controlling them.

Some of the more important insect pests are given below:—

Split-worm (*Gelechia operculella*)—

The greatest injury done by this insect is while the plants are in the seed-beds. The moth deposits its eggs on the leaves and stems of the young plants, and the larvae which hatch from the eggs enter the leaves and sometimes the stems. The effects can be noted from the dry, papery streaks or patches in the green leaf where the insect has been burrowing, and also in some cases by an enlargement of the stem. The larvae do not spend their whole stage in one leaf, but usually attack more than one.

This migatory habit can be taken advantage of to combat them. The remedy is an application of arsenate of lead. It should be used in the proportion of 1 oz. to 16 gallons of water, but if no suitable scale is at hand for weighing, a large tablespoonful to 2 gallons of water is sufficiently accurate to give good results.

The poison should first be thoroughly suspended in about 1 quart of water, and then added to sufficient water to make 2 gallons. When properly prepared the mixture should have much the same appearance as milk. Arsenate of lead, which can be purchased at any up-to-date chemist shop, can be applied with an ordinary sprinkling can if no sprayer is at hand.

There is no danger of damaging the plants by a heavy application, but there is no necessity for waste. After an application the plants, when dry, should have the appearance of having been whitewashed.

When the larvae enter the stems there is no remedy, and the plants should be destroyed, since they are practically useless for transplanting.

Cut-worm (*Noctuidae*)—

There are several species of this insect which attack the young plants in the field. Since they do their mischief at night and go into the ground during the day, the only measure which can be resorted to is the use of poisoned bait. The so-called bran-arsenate mash is highly recommended by several entomologists. This bait is prepared by thoroughly mixing 1 lb. of paris green with 50 to 75 lb. of bran, and, just before using, the mixture is sweetened with a little syrup or sugar. When the cut-worms are known to be numerous this bait should be scattered in the lands a few days before transplanting.

Wireworms (*Elateridae*)—

The grub attacks tobacco in the field and does considerable damage. When attacking the young plants, the grub enters the stalk at the surface of the soil and burrows down inside the stalk, thus destroying the plant; but when the plants are large the larvae girdle the stalk at the surface of the ground, and the plant is blown over by heavy winds. We do not know of any specific remedy for this pest,

but no doubt winter ploughing will help to diminish their numbers. Their attacks are worse in dry seasons than in wet seasons.

The Bud-worm (Heliothis rhexial)—

The adult of this insect is a moth, but it does its damage in the larvae or caterpillar stage. The principal injury in the Transvaal is done to the seed pods, but it also attacks the bud of the plant just before the flower head appears. We have seen many cases in which this pest had entirely destroyed all of the pods on a seed plant. The eggs are very small and light in colour, so that they cannot easily be seen on the calyx of the flower, where they are usually deposited. In preparing the seed head for the reception of the paper bag, the eggs, if any are present, should be destroyed, or else the seed head should be sprayed with arsenate of lead. If no preventive measure is taken the seed head will be destroyed if eggs have been deposited before the bag is placed over it, as the bag forms an ideal protection for the caterpillar.

Grasshoppers—

There are several species of grasshoppers which attack tobacco and do much damage by eating large, irregular holes in the leaves. They are not numerous as a rule, but each one is capable of ruining many leaves. Hand-picking is the most effective remedy. This work can be done in connection with topping and suckering.

Nematodes (Heteroda radidicola)—

This pest is not an insect but a worm. It is by far the most serious pest with which tobacco growers have to contend. It attacks the plants both in the seed-bed and in the field. Its presence is shown by the distorted and warty appearance of the roots and by the stunted and unthrifty appearance of the plants. Tobacco transplanted on land badly infested with nematode rarely comes to proper maturity, but slowly wilts down, beginning with the bottom leaves, and unless the plants are harvested before they have time to reach maturity they die. The cured leaf from such plants has a light colour, as a rule, but it is small and papery and has little real value. The attack of the nematode is more serious in dry seasons than in normal seasons, since the plants do not grow so vigorously and are much more susceptible.

There is no specific remedy known at present which can be economically applied to tobacco in the field, but much can be done to alleviate conditions in infested fields. Land known to be infested with nematode should not be planted to tobacco, potatoes, tomatoes, cabbage, or cauliflower for at least two or three years. The best plan is to let the land lie fallow and keep it clean of weeds in order to starve out the pest. If the farmer is short of land the infested area may be planted to a crop which is not attacked by nematode, such as mealies.

Since land can become infested with nematode by planting it with infested plants, the greatest care should be taken to secure healthy plants for transplanting. Whether or not the site selected for seed-beds is known to be infested with nematode, the soil should be thoroughly burned to be on the safe side.

SUCKERING.

When the plant is topped nature is foiled in her attempt to produce seed for reproducing the species, and she attempts to secure

this end by sending out suckers. These, however, should be broken off so that the food elaborated in the leaves is not carried to the younger growing parts, but is stored up in the leaf. This not only increases the size of the leaf, but gives the cured product more body. Different varieties of tobacco vary as to the number of times they produce suckers, but practically all varieties produce them two or three times.

RIPENING.

When the plants are young and growing rapidly the leaf has a dark green colour, and is very pliable. Garner* has pointed out that the intense green colour shows that the leaf is rich in nitrogenous constituents, which go to make up the living or vital parts of the leaf, and which are active in building up the food supply of the plant. He further states that "at about the time the leaves of the plant as a whole have reached their maximum power of elaborating the food supply the flower head begins to develop. This food supply, consisting of starch and other similar substances, is carried from the leaf into the seed head to furnish the necessary food for the development of the seed. This accomplished, the leaves have completed their full task, and they now pass into the period of gradual decay. In practice, however, the plant is topped, so that the seeds are not allowed to develop. Making a last effort to reproduce itself, the plant now sends out secondary shoots or suckers, but these too are removed by the grower. Under these circumstances the food built up by the leaves is not carried away to other parts of the plant but accumulates in the leaves themselves. The result is that both the size and body of the leaf are increased.

"The principal indication that the above-mentioned processes are taking place is a decided change in colour. When the reserve food supply of the leaf is no longer required for the nourishment of other parts of the plant it is deposited in the leaf tissue in the form of starch granules, while the green colouring matters are dissolved and carried to the younger growing parts. This interchange causes the appearance of the light-tinted flecks so characteristic of the ripe leaf. Moreover, the accumulation of the starch granules in the leaf causes it to become brittle, so that it snaps when folded between the fingers, another characteristic sign of ripeness."

The secret of curing tobacco successfully lies in knowing exactly when to harvest the plants, so that they are neither too ripe nor too green. To obtain the best yellow and light red leaf the plants should stand on the land until fully ripe, so that the green colour will be reduced to a minimum and the yellow colour developed as far as possible before being placed in the curing barn.

HARVESTING.

There are two methods of harvesting tobacco; the whole plant and the single leaf. The former is the more economical method of harvesting for air-curing, but it has a disadvantage in that all of the leaves are not in the same stage of ripeness and hence do not, as a rule, cure a uniform colour. In harvesting the whole plant, the stalk is split by a single stroke with a tobacco knife to within about 4 inches of the ground. The stalk is then slightly bent away from the person

* Bulletin No. 143, U.S.A. Bureau of Plant Industry.

cutting and severed near the ground by a sloping cut. The plant is then placed astride a lath, small poplar pole, or strong reeds which will carry from six to eight plants, depending on their size, and. as the laths are filled, they are hung on a tobacco frame or tobacco trolley and carted to the curing barn where they are hung in the tiers. A very serviceable frame for use on an ordinary wagon is shown in Fig. 11. By taking off the body of the wagon the frame can be set securely on the running gear of the same.

For flue-curing the single leaf method should be used. To successfully cure tobacco in a flue-barn all of the leaves must be of the same ripeness, so that all of them will yellow at practically the same time. This can only be accomplished by using the single leaf method, since the bottom leaves of a plant ripen first, therefore all the leaves are not ripe at the same time.

The ripe leaves are stripped from the plants on the land and placed in large flat baskets. As the baskets are filled they are conveyed to the flue-barn or better to an open shed near by. The leaves are then strung on wires about 9 inches long, attached to the laths at right angles, and secured with wire-netting staples. Six to seven wires can be attached to each lath, and each wire will carry from eight to twelve leaves. The first leaves to be harvested are, naturally, the lower ones, since they ripen first, then the middle leaves, and finally the top leaves, so that three pickings are necessary to harvest the whole of the crop. This method requires more labour in harvesting but less fuel is used in curing, and a higher percentage of yellow leaf is obtained. In harvesting by the single leaf method, the bottom leaves can be picked when in the proper stage of ripeness; thus preventing waste, which must occur if the grower waits for the middle and top leaves to reach the proper stage of maturity.

CURING.

Tobacco can be cured either with or without the use of artificial heat. When no artificial heat is used the method is usually spoken of as air-curing, and when artificial heat is used the method is described as flue-curing or open fire-curing, according to the method used in distributing the heat.

Air-curing—

This method is generally used throughout the Union of South Africa. The conditions which are most suitable for the curing of bright tobacco by this process are clear, calm days, dry atmosphere, and a temperature of 80° to 90° F. in the shade. Where these conditions prevail the moisture is absorbed by the atmosphere as rapidly as it is given off from the leaf, and therefore oxidation does not take place, or takes place very slowly, so that the leaf is dry before the dark red or brown colour can appear. Normally all tobacco should take on a yellow colour after harvesting and before it begins to dry. If the tobacco dries out before the yellow colour appears the leaf will remain green and be of very little value. After the tobacco becomes yellow, drying should be hastened as rapidly as possible in order that the colour may become fixed before the leaf can change colour.

In the low corrugated iron sheds the leaf dries rapidly in fine weather, and since these sheds are practically open and therefore well ventilated the moisture is absorbed by the dry atmosphere almost as fast as it is given off; hence the conditions favourable for oxidation

are reduced to a minimum and the tobacco cures a light colour. In very windy weather, however, the tobacco in these sheds often dries before yellowing, which points to the fact that they should be provided with some method of regulating the ventilation when required. Wet bags, hung around the sides, would probably have a beneficial effect under such conditions.

Flue-curing—

In the flue-curing process the heat is distributed by means of flue-pipes and is maintained throughout the process. The aim of the grower is to hasten the yellowing of the leaf, and when the proper yellow colour is acquired to dry out the leaf so that it still retains the desired colour. To secure this end three things are necessary—proper soil, suitable climate during the growing season, and correct management of the barn during curing.

Many formulas have been given for curing tobacco by this method, and any of them are correct under certain conditions; but, unfortunately, we are not always able to make the conditions suit the formula, so that we must suit a formula to the conditions.

Tobacco grown on different types of soil, and often tobacco grown on different parts of the same field, require different periods of time to yellow and to dry out. The same applies to different varieties grown on the same soil. Hence it will be seen that the formula which is correct in one case would be slightly wrong in the other.

Although no fixed and definite formula can be given, we can give some general directions which, with good judgment, the grower can modify to suit his particular conditions.

In flue-curing, when properly managed, there are four stages to be observed, viz., the yellowing of the leaf, fixing the colour, drying the leaf, and drying the midrib and the stalk, if the whole plant is harvested.

The Yellowing Stage—

The barn should be filled in one day, or less, if possible, so that the leaf will all yellow at about the same time. When filled the barn should be tightly closed, to prevent the escape of moisture, and a small fire started in the furnace. When the fire is started a thermometer and hygrometer are placed in the centre of the barn on a level with the first or lower tier of tobacco. The hygrometer is used to indicate the amount of moisture in the atmosphere of the barn and is of great assistance during this stage of the curing.

At first only a small fire is required, but this is gradually increased until the thermometer registers about 90° F. This temperature is maintained for about ten to twelve hours, or until the tobacco begins to wilt, and is then increased about 2° per hour to 100° F. The barn is then kept at this temperature until the tobacco begins to yellow rapidly, when the heat is increased to 110° F. The temperature should be held at this point until the leaf is practically a lemon yellow.

During the yellowing stage the atmosphere of the barn must be kept moist. This is when the hygrometer is invaluable. Enough moisture must be kept in the atmosphere of the barn during this period so that the temperature registered from the wet bulb of the hygrometer will not be more than 3° to 4° below that registered by the dry bulb. If a depression of 3° could be maintained the leaf would yellow more rapidly and more uniformly. When the wet bulb registers more than

4° below the dry bulb it indicates that the atmosphere is becoming dry, and artificial moisture must be introduced into the barn. This can be done by wetting the walls below the tobacco, by pouring water over the floor, or by placing wet bags on the flue-pipes.

Fixing the Colour—

When the tobacco is properly yellowed the barn must be so managed that no further change of colour takes place in the leaf. This is the critical stage in the curing and requires the closest attention and the most careful manipulation. If the atmosphere of the barn is too humid, or if the ventilation is not sufficient, and the temperature is not increased fast enough, moisture will collect on the surface of the leaf and the tobacco will turn a reddish brown colour or "sponge," which decreases its value.

On the other hand, if too much ventilation is given, and the temperature is increased too rapidly, the leaf will be killed too quickly and a greenish red or black colour will develop, which greatly reduces the value of the leaf.

The proper conditions are maintained when the barn is so ventilated that the moisture is carried off as fast as it comes to the surface of the leaf, and the temperature so regulated that the colour will be fixed in fifteen to eighteen hours. To secure these conditions the bottom and top ventilators must be slightly opened as soon as the tobacco yellows and the temperature gradually increased from 110° to 115° F. The temperature should then be kept at 115° F. for about six hours and then increased to 120° F. and kept at that temperature until the leaf begins to dry, then the temperature should be advanced to 125° F. and kept at that point until the leaf appears to be practically dry. By that time the colour should be fixed.

Drying the Leaf—

To thoroughly dry the leaf the temperature is increased to 130° F. in two hours, and held at that point from four to six hours, and then increased to 135° and held for another six hours, when the body of the leaf should be quite dry.

Drying the Midrib—

When the leaf is dry the ventilators may be closed and the temperature raised to 140° F. in one hour and held at this point for about four or five hours. The temperature can then be increased about 5° per hour up to 160° F. and kept for about six hours, when the the midrib will be dry enough to snap when bent between the fingers. If the whole plant is being cured the temperature should be increased to 180° F. and kept for eight to ten hours to thoroughly dry out the stalk.

From four to six days are required to cure a barn, depending principally on the length of time required for the tobacco to yellow. The above temperatures are only given to serve as a guide, and each grower must modify them to suit the conditions which, according to his judgment, are existing at the time he is curing.

It might be well to point out that the rate of curing is influenced considerably by the temperature of the outside atmosphere, which replaces the air in the barn when ventilating. It will be found that higher temperatures are required in wet weather than in dry weather, and that lower temperatures are required in cool weather than in warm weather.

PREPARATION FOR MARKET.

After the tobacco is thoroughly dry the next and final step is preparing the leaf for market. When tobacco has been cured in an air-curing barn it usually hangs until rain falls, when the leaf becomes moist and pliable. If the tobacco has been harvested early it will cure in time to be "stripped" with the late rains of the same season, but the late tobacco must hang until the rains of the following year. Unless the barns are properly enclosed considerable loss occurs, and, moreover, this part of the crop represents so much capital which cannot be touched. There are, however, two methods of artificially moistening tobacco which are applicable to South Africa, and which, if used, would do much to alleviate existing conditions.

The first method is commonly spoken of as the pit system. A pit about 5 feet wide, 6 feet deep, and any convenient length, is dug and arranged in the same manner as the curing barn with reference to hanging up the tobacco. The tobacco is then hung in the pit in the same way it is hung in the barn, and water is led into the pit until it is about 2 inches below the tips of the leaves. The pit is then covered with a buck sail upon which is placed wet grass. In about twenty-four hours the leaf will be pliable and the tobacco can be removed and stripped and the pit refilled. This method is slow but it is not expensive, and, moreover, the leaf remains in good condition and does not change colour. Where only small amounts of tobacco are to be prepared for market this method can be used to advantage, but where the crop is large it works too slowly to be successful.

When the grower can bear the expense of purchasing a boiler, the use of steam is preferable for bringing the leaf in stripping order. Where steam is used for moistening the tobacco a closed room is necessary. The tobacco is hung in the room in the same manner as it is hung in the barn and, when filled, steam is liberated slowly so that the atmosphere becomes saturated with moisture, which in turn is absorbed by the leaf. By this method much more tobacco can be handled in the same time than can be handled in a pit, but more expense is incurred.

The boiler used should be of a type which has a large heating surface so that steam can be generated rapidly and allowed to escape into the room without being under pressure. If too much steam is allowed to escape into the room the tobacco will, in time, become wet rather than moist and the colour will become darker.

When the tobacco has been cured in a flue-barn it can be steamed in the same building. The tobacco should, however, be allowed to become cool before steam is turned into the flue-barn.

Whatever method is used to get the leaf in order the method of stripping and grading should be the same. When the leaf has absorbed sufficient moisture to make the midrib soft and pliable, the tobacco is ready for taking down and grading.

In grading, leaves of different colour, length in quality should not be placed in one "hand" (bundle), but separate classes should be made for each. The yellow leaf should be tied into separate hands and made into separate bales as also should the light red leaf. Sand and damaged leaves should be placed in a separate grade, and the same applies to dark, heavy leaf. When dark leaves, sand leaves, and light red leaf are all placed in the same grade, the grower cannot expect a higher price for the whole than he could procure for the lower grades, since the manufacturers cannot take the time to open the hands and regrade the tobacco which they purchase.

After the leaf has been properly graded, classified, and tied into hands, it should be pressed into bales. For baling, tobacco should be only moist enough to bend without breaking, but should not be wet. When bright tobacco is baled with too much moisture in it there is danger of the leaf fermenting, which will cause the colour to become darker and thereby decrease its value. If, however, the tobacco does not contain too much moisture when put into the bale the colour will improve, hence the leaf will command a higher price.

When the bales are finished they are bound with wire, and then covered with sacking or hessian to prevent the leaf from drying out, and also to insure protection against breakage and dust.

The grower should always remember that tobacco prepared in an attractive manner sells itself. This fact, however, is often lost sight of, and many growers, by not properly preparing their leaf for market, allow their profits to slip through their fingers at the end of a long season of hard work.

Sheep and Wool.

By CHAS. MALLINSON, Principal Flockmaster.

History of the Merino Sheep.—Many efforts have been made to trace the early history of the Spanish merino, but with little success. It has been supposed that the earliest sheep were introduced into Spain from Barbary. Certain it is that merinos were most jealously guarded and cared for by the Spaniards, so much so that at one time the exportation of merinos from Spain was forbidden under the penalty of death. In the year 1464 King Edward IV. of England gave a licence to pass over certain Cotswold sheep into Spain. They were used to improve the length of staple in the Spanish merino. Spanish sheep were divided into two classes—the "stationary" and the "migratory"; the former was not as valuable as the latter, its wool being much coarser and longer in the staple than that of the latter, and almost devoid of crimp. The migratory flocks consisted of the true merino type. The custom was for the migratory sheep to be driven to the mountains for the hottest season of the year, and to return to the lowlands for the winter. By the laws of the Mesta a path, ninety yards wide, was left open for them to travel through the cultivated country. On their way up or down the shepherds might not take one branch of a tree for firing. Sheep folds were constructed for the night of native grasses. In heavy rain the animals were driven to sheltered situations. Jacobs, in 1809, writes: "The shepherds do not permit the merino to leave the folds till the sun has exhaled the dews of night, nor do they allow them to drink from a brook or

pond after it has hailed." That the danger, from an agricultural point of view, of permitting these extensive treks was fully recognized is indicated by the Statute of Ferdinand of Portugal: "That no person who was not a husbandman, or his servant, should keep sheep, either for himself or for others; and if any other person were desirous of having them they must oblige themselves to cultivate a certain portion of land, under the penalty of losing their cattle if the regulation was not exactly complied with."

Spanish Merino described.—It is considered that the best description of the Spanish merino is given by Youatt: "The legs are long, yet small in the cone; the breast and the back are narrow, and the sides somewhat flat; the fore-shoulders and bosoms are heavy, and too much of their weight is carried on the coarser parts. The horns of the male are comparatively large, curved, and with more or less of a spiral form; the head is large, but the forehead rather low. A few of the females are horned, but, generally speaking, they are without horns. Both male and female have a peculiar coarse and unsightly growth of hair on the forehead and cheeks, which the careful sheepmaster cuts away before the shearing time; the other part of the face has a pleasing and characteristic velvet appearance. Under the throat there is a singular looseness of skin, which gives them a remarkable appearance of throatiness or hollowness in the neck. The pile, when pressed upon, is hard and unyielding." (Youatt, p. 148.)

Like the wonderful sheep of Arabia, mentioned by Herodotus, the original sheep of South Africa were fat-tailed animals, some a dirty grey colour, some black, but chiefly a dull, reddish brown. Their fleeces were of hair rather than wool, though the native Afrikander has a woollen down next to the skin, which is overgrown with hair. Barrow describes the Cape sheep of his time as follows: "They are long-legged, small in the body, and thin in the forequarter and across the ribs. They have little internal or external fat, but it is all collected on the rump and on the tail. They are covered with strong, frizzled hair, of which little use is made except for cushions and mattresses." There are still one or two so-called pure-bred Afrikanders in existence, though it is doubtful whether any of them are just what they are represented to be, for, from the date of the landing of the first colonists, attempts have been made to breed a larger frame and a wool fleece in place of the scrawny body and hairy growth peculiar to the indigenous breed. In these attempts to improve the local flocks practically every well-known breed has been used for crossing on them, including merinos, Leicesters, South Downs, Suffolk Downs, Devons, and Romney Marsh. Probably the cross which has been most popular with the local farmers has been the Afrikander-Persian. The resultant progeny is used chiefly for slaughter purposes, for the fleece has little value, whilst even for the butcher the carcass is not so heavy, nor the flavour and quality of the meat so excellent, that the experiment can be regarded as a success.

Improving the Afrikander.—Speaking of the earlier attempts to improve the Afrikander, it is said that "when the value of the merino wool began to be acknowledged, a few of the Spanish sheep were sent to the Dutch Colonies at the Cape of Good Hope, but the native sheep seemed, from the nature of its covering, to be so plainly adapted to the

situation in which it was placed, and the prejudice was so strong and so universal, that it would be useless to attempt to preserve the fineness of the merino wool in the torrid clime of South Africa, and perhaps the prevailing notion of the use of the fat obtained from the tail of the Cape sheep, was so various and so identified with the likings and habits of the colonists that few of the Dutch colonists could be induced to give the newcomer even the shadow of a trial. . . . The difficulties which at first opposed the establishment of the merino sheep have now been conquered, and wool of excellent quality from almost every part of the Colony, and particularly from the eastern districts, have been sent to England." To-day the tendency is to leave the Afrikander sheep alone and to purchase woolled sheep. The general rule throughout the country is that the farmer who devotes his time to Afrikanders and cross-breds is the least progressive sheep man in the country.

Breeding.—Youatt observes: "The object of the sheepmaster is to raise and retain that animal which will pay best for the consumption of its food." The first step in breeding is the classing of the flock, for unless this has been done, and done properly, any subsequent time, trouble, or money expended in breeding sheep will be thrown away. Let it be supposed, for the sake of illustration, that a stud breeder has 500 stud ewes. Say we class them into four lots—fine, medium, and robust wools, and what we would term a dense-woolled family carrying medium quality wool. Now, in classing these 500 ewes, reject those which do not come up to a certain high standard which you have fixed in your mind's eye. The rejected portion would form a sort of second stud. Having classed these 500 ewes, and having got a fair proportion—say, 60 each of the different qualities mentioned—the next step is to procure rams for each portion. That is to say, we must have a fine, medium, and a robust-woolled ram. Also a ram carrying a dense fleece of medium quality wool. All should show wool of good length and style. The ram should be of a bold and masculine appearance, with a good, broad, straight back, and well-sprung ribs. He should stand firmly and squarely on his four feet, and be as near as possible to the ideal sheep. The ewe should be a little finer about the head than the ram, with good conformation.

In managing pedigree stock of any kind it is a generally-accepted principle that line breeding is necessary to stamp typical characteristics: without it you would never get that uniformity of type which is the object of the flockmaster's ambition. Unless you are willing to give time and attention to valuable stock, do not be too anxious to acquire such. Remember any animal must have rational treatment to give profitable results.

Hints on Mating.—With regard to mating, first of all we will take the fine-woolled ewes, say 50, and with them we will mate the medium-woolled ram (it is understood that the wools of the three rams—fine, medium, and robust—are of medium density and a good combing length). In order to keep this medium-woolled ram's family going, we take ten or a dozen of the medium-woolled ewes (possessing none of the faults which the ram may happen to have), with the idea or expectation of producing a superior sire to the one of that particular family you are already using. In the event of a better sire not turning up from the ten medium ewes, it will be necessary later on to put all the medium-woolled ewes to the medium-woolled ram,

because it is just possible that ewes outside the dozen—although, so far as one can see, not so well suited to the ram—may produce the young sire you are wanting. Let us now take the remaining 50 of the medium-woolled ewes and put them to the fine-woolled ram, with ten or a dozen of the pick of the fine-woolled ewes to keep that family going. Now give the robust-woolled ram 50 dense and 10 robust-woolled ewes. Next the dense-woolled ram takes 50 robust-woolled and 10 dense-woolled ewes.

The same procedure may be followed in the two latter as in the two former cases in order to get a superior sire. This would also increase the number of pure ewes of each particular class. A sheep that has been bred from within its own particular breed and family line (it is only natural to suppose) would be more prepotent than one that has many breeds in its composition. The reader will notice from the above that extreme mating of the families have been avoided. These families should be carefully pedigreed so that close in-breeding may be avoided. The object of this mating is to get a uniform wool of good, even quality and length in your stud and general flock, and still to maintain the four distinct lines. A good ram bred by yourself is worth two you buy, and in many cases a great deal more. The best of the rams bred in these families could be used in the second stud or the rejected portion of the 500. From these you would also breed very good rams that could be used in the general flock, assuming, of course, that they have been classed.

Classing Sheep.—Constitution. Nice frame, and a fleece of a fair combing length and density, showing a good crimp from the skin to tip are indispensable in good sheep breeding, bad points are in regard to the wool on the sheep, weak backs, wool parting right down the middle. It is important that sheep should have sound backs or the fleece will be cut right in two, as it were. Crape wool, or what is known as watery on the belly and point of foreleg and between folds on neck, rough, coarse stuff on the brich. Straight-haired and mushey. Short, fatty, and badly bred wools are all points to be avoided. Sheep with big folds on the body so far as the fleece is concerned are of a most uneven character. The object is to get the covering as even as possible; the more even the wool the higher the price per pound. Big folds or wrinkles do not mean density, it means a larger skin than the sheep is able to fill out. When wool gets too far away from the flesh it gets wild, staring, wiry. In my opinion some judges give too much attention to wrinkles and hair instead of to wool. Sheep should not have a bigger load stacked on than they are able to carry and look for their living unless you are prepared to artificially feed. Overloaded sheep are the first to die when hard times come; if it is desired to breed good sheep you must pay the same strict attention to the breeding ewes as you do to the rams. The merino sheep is a most cosmopolitan animal, and responds most readily to good treatment; it will thrive in most countries fit for sheep to live in. If one is trying to establish certain points in sheep or to breed out certain defects the quickest way to succeed is by culling and careful selection.

Classing of the General Flock.—I am afraid that it is the custom with a good many farmers in South Africa to do the culling of their breeding ewes when they are visibly aged or broken mouthed. By that time the inferior ewes have done all the harm they can. Their

descendants are still carrying on and transmitting the bad qualities to the next generation. The farmer who carries on the business of sheep breeding in this way will never succeed in his profession. The correct plan is to class all the young ewes before shearing. Bring them to the yard, catch and examine each in turn. Care should be taken not to cull for frame alone or for wool alone. Adhere to the happy medium, and gradually the eye and hand working in intelligent sympathy will tell, with seldom failing accuracy, by the look of the animal and the grip of its wool, whether the particular sheep has to be more carefully examined for possible rejection. It should be the object of the breeder to have the flock after classing as even as possible—even if he has to cull—say, five per cent. more than in previous years. We cannot here lay down any hard and fast rules as to what proportion of culls should be taken out of a flock. I have classed sheep in Australia for over twenty years, and I do not remember ever taking less than ten per cent. out of any man's flock—I have taken out to thirty per cent., but I should say the average culling there to-day would be from fifteen to twenty-five per cent. If the sheep breeders of South Africa wish to get up to the Australian standard they will have to carry out an equally *thorough system of culling*. I know of no other way by which it is possible to breed good sheep. The question may be asked: "Where do these culls go?" In many instances they are sold to farmers who breed fat lambs for market, but it is only right to say before putting them to the ram (which should be of some English breed) he would take all the small ones out and fatten them for the butcher. It is anything but sound policy to keep poor, low quality sheep when their places might be filled by a better lot. The change may be brought about gradually and need not call for any great expense if the classing is kept up every year. The best and quickest way to succeed in sheep breeding is by close culling and careful selection. There is no such thing as a short cut.

What a good Ewe is.—A sheep of sound constitution and good frame ought to carry a fleece of combing length, the wool showing a decided crimp from the skin to the tip. Wool of this character and style should not only form a kind of saddle on the sheep's back, but extend all over the body, belly, and joints. Any sheep not coming up to this standard is more or less faulty. Wool on the sheep's head should not come below the level of the eyes. I think some breeders make a great mistake when they develop the wool right to the nose. It may seem a small point, but in the writer's opinion it is interfering with nature too much. Sheep so blindfolded have not the same chance to look for their living as those with open faces. The face and ears should be soft and silky. The mouth should neither be under or over shot.

Preparation of Wool.—Many sheep farmers seem to have an idea that anything they put in the bale will help to swell the money value of such wool. This is a very great mistake, and does much harm to the industry. Farmers must thoroughly understand that any foreign matter sold with the wool actually reduces the price, because it costs the manufacturer money to get rid of it. If the farmers of South Africa would take into consideration that wool buyers are specially trained men, and are always on the lookout for any faulty packing, there would very soon be a great improvement all round. Seeing

that the export of wool from South Africa has risen from £2,768,086 in 1908 to £4,780,594 in 1912, it is a matter of very great importance to this country that the farmers should learn how to grow the right kind of wool and be able to present it for sale so as to command full market value. Always remember when there is carelessness shown the value of the wool will most certainly fall. The very lowest class of wool has its price, but if left on the fleeces it reduces the price of such fleeces. String, jute, fibre, chaff, straw, and dust, in fact anything which is not wool is not wanted by the manufacturer; the presence of these articles in wool reduces the price very considerably, because he has to get rid of them. It is a strange thing that after spending so much money and talent on the production of wool many farmers' clips are displayed in a most unattractive manner.

Skirting, rolling, classing, and pressing should be done as though the buyers were on the spot. The object of classing wool is to get it up in such a way as to make it attractive in the saleroom, and in distinct lots according to quality and condition, so that the buyers can fix their maximum value in the minimum of time. How many farmers argue that it does not pay to class. They say: "Mr. So-and-So's wool was classed last year, and I put everything in the bale and the result was the same." This way of looking at it is all right as far as it goes, but was the wool the same quality as the other chap's? Was the condition the same? And was there the same amount of vegetable matter in it? These may seem only trifles to the growers, but to the buyer they would make a difference of a penny per pound.

The Tick-killing Properties of Sodium Arsenate.

By H. E. Laws, B.Sc., F.I.C.

II.

In the first paper on this subject* it was intimated that further investigations on the question of the tick-killing properties of sodium arsenate were being carried out in order to ascertain accurately the comparative tick-killing properties of arsenite and arsenate. The results of previous work* indicated that arsenate was about half as active as arsenite, and this confirmed the opinion formed by Brunnich.†

The need for knowing the value of arsenate of soda as a tick destroyer has arisen as a result of investigations which have been carried out by Brunnich,† Fisher,‡ and others, who found that cattle dip washes on long standing deteriorated in strength and that this deterioration was due to oxidation of arsenite of soda to arsenate.

Since the first paper on this subject was written, other investigators, including Lewis§ and Williams,‖ have been carrying out experiments on the oxidation of arsenite to arsenate in a cattle dipping tank. Lewis determined the arsenite and arsenate present in several samples of cattle wash. In one particular sample he found that about half the arsenic was present as arsenite and the other as arsenate when he received it at the laboratory. On allowing it to stand in an open bottle all the arsenite changed very quickly to arsenate. Another sample on arrival contained little or no arsenate, but on standing in the laboratory for a week all the arsenite became changed to arsenate.

Williams in his investigations took a sample of dip from a tank which was being used regularly once a week, determined the arsenite and arsenate in it, then allowed it to stand in the laboratory and examined it each month, and at the same interval he took further samples direct from the tank and determined the arsenite and arsenate exactly as before. As a result of these experiments it was found that very little change took place in the dipping tank, but within a few months the arsenite in the dip standing in the laboratory all became changed to arsenate.

It appears then that, in order to prevent the deterioration of the dip, cattle should be put through it at frequent intervals. Fisher¶ has proved that the change is brought about by bacteria. It would appear then that the oxidation bacteria do not get the upper hand

* Previous paper by W. F. Cooper, B.A., F.Z.S., F.L.S., and H. E. Laws, B.Sc., F.I.C.

† Notes on Dipping Fluids. Composition and change during use. Read before Australasian Association for the Advancement of Science, by J. C. Brunnich, F.I.C.

‡ U. S. Department of Agriculture. Bureau of Animal Industry. Circular No. 182. The Spontaneous Oxidation of Arsenical Dipping Fluids, by Aubrey V. Fuller.

§ Oxidation of Sodium Arsenite to Sodium Arsenate in Cattle Dipping Baths. Read before the Upper Albany Farmers' Association, 4th March, 1913, by Dr. J. Lewis.

‖ The *Agricultural Journal of the Union of South Africa*, January, 1913. Oxidation of the Arsenite of Soda in Dipping Tanks, by C. Williams, B.Sc., A.R.C.S.

¶ U. S. Department of Agriculture. Bureau of Animal Industry. Circular No. 182. The Spontaneous Oxidation of Arsenical Dipping Fluids, by Aubrey V. Fuller.

unless the tank is allowed to stand idle for a time. Now, in order to explain the difference in the behaviour of the dip in the tank which is used frequently and the dip left in the laboratory, it has been suggested that in the tank there are two kinds of bacteria, the first oxidizes the arsenite to arsenate, whilst the second reduces the arsenate back again to arsenite, so that the reason why no change is noticed in the dip in the tank, which is constantly in use, is that the reducing bacteria counteract the effect of the oxidizing bacteria. However, it appears that the reducing bacteria die out very rapidly, and unless the supply is kept up by putting cattle through the tank at regular intervals the oxidizing bacteria get the upper hand and the strength of the dip deteriorates. It seems then that the solution to this problem, how to maintain the strength of a dip in a tank, is to put cattle through it at regular short intervals, thus supplying reducing bacteria to counteract the effect of the oxidizing bacteria which do not die out in the tank. Another solution which suggests itself is to use a dip with bacteriacidal properties which will prevent the growth of the oxidizing bacteria.

It appears now that this question of the formation of arsenate, and hence the reduction of the tick-killing effect of cattle dips, has been very much exaggerated. In the first place very little oxidation takes place in a cattle tank which is constantly in use, and, further, arsenate of soda when formed is a valuable tick-destroying agent, as the previous experiments as well as the present ones have demonstrated.

In these experiments the cattle were hand-sprayed as before, but in this case one animal was sprayed all over with the same solution, and not, as on the previous occasion, with one solution on the fore part and another on the hind.

Arsenate was used at a greater strength than on the previous occasion in order to ascertain at what strength it would kill all the ticks on the animal at one spraying, and also to discover at what strength it would produce a visible effect upon the skin and constitution of the animals. For all practical purposes it may be concluded that arsenate combined with a standard emulsion will clean a tick-infested animal in one spraying if used in the proportion of 1 part to 150 parts of water. Even when used at 1 to 100 it did not kill every tick, but then arsenite of soda failed to kill female bont ticks when used at half this strength, 1 to 200, although it scalded the cattle.

There is very little difference between the activity of arsenate at 1 to 150 and arsenite at 1 to 300, but what difference there is is in favour of arsenite.

The arsenite and arsenate used in these experiments contained 66 per cent. of arsenious oxide and arsenic oxide respectively.

The work could not be carried out at Messrs. William Cooper and Nephews' farm at Gonubie Park, as there are no ticks there now, so the experiments were made on a neighbouring farm belonging to Mr. F. Kruuse, to whose kindness for the loan of animals I am indebted.

SERIES I.

Black and White Cow.

Ticks: Number of bonts on udder; browns and reds around ears.
24th December. Dip: Arsenite 1 part, 300 parts water.

26th December. Three female bonts dead and four males; few browns and reds still alive.
27th December. One female bont dead; other ticks all dead.
30th December. Two more female bonts dead; bunches on udder still alive; other ticks all dead; not scalded.

Yellow Heifer.

Ticks: Browns in ears; bonts on udder.
24th December. Dip: Arsenite 1 part, Standard Emulsion 1 part, water 300 parts.
26th December. Four male bonts and one female dead: rest of ticks all dead; animal blowing badly.
27th December. Three female bonts dead; rest all dead; blowing badly and slightly scalded on back.
30th December. Two more female bonts dead; six still alive; still blowing and slightly scalded.

Black Cow, white flank.

Ticks: Big bunch browns and bonts at back of udder; reds around anus; two female bonts on udder; browns at back of ears.
24th December. Sprayed with arsenite 1 part, Standard Emulsion 1 part, water 150 parts.
27th December. Browns and reds killed; about 50 per cent. of male bonts dead; two female bonts dead; rest alive.
30th December. No more female bonts dead; two russet ticks engorged and alive; large bunch of bonts at back of udder all alive; not scalded.

Black Cow.

Ticks: Bunch of male and female bonts at back of udder; red around anus; several browns in ears.
24th December. Dip: Arsenate 1 part, Standard Emulsion 1 part, water 150 parts.
26th December. Few reds and browns still alive; one female bont and three males dead; not scalded.
27th December. Male bonts nearly all dead; no more females dead.
30th December. No change, female bonts apparently affected by the dip as they have not increased in size in six days.

Black Cow.

Ticks: Male and female bonts near udder; bunch of reds including female around anus; three female bonts, four males, and ten browns on escutcheon; several russets (one pilosus), two male and female bonts on left shoulder: three male and female bonts in right dewlap; large numbers of browns and reds in and around ears.
24th December. Dip: Sprayed with arsenate 1 part, water 100 parts.
26th December. All brown, russet, and red ticks dead; three male bonts dead; females obviously affected but not dead; not scalded.
27th December. Two male bonts still alive; two female bonts dead, eight still living; one female red still alive; cow not blowing nor scalded.
30th December. No more ticks dead.

Black Cow, white udder and two white feet.

Ticks: Well infested; male and female bonts on udder and around anus; russets on dewlap; browns in and around ears.

Dip: Sprayed with arsenate 1 part, water 100 parts, acid Standard Emulsion same proportion.

26th December. All ticks but bonts dead; three female and male bonts dead; not scalded.

27th December. Two more female bonts dead.

30th December. Two more female bonts taken off dead; ten more obviously affected but not dead, have not increased in size since spraying; other ticks all dead; no scalding.

Conclusions from Series I.

Results of spraying 1 and 2. Arsenite 1—300 with and without emulsion were slightly better than 3 and 4, Arsenate 1—150 with emulsion but they were not so good as 5 and 6, Arsenate 1—100 with and without emulsion.

From these results it would appear that arsenate is slightly less than half as active as arsenite.

Further, animal No. 1 was blowing very badly and was slightly scalded on the back. Nothing of this was noted with animals Nos. 5 and 6, although the tick-killing effects with dips 5 and 6 were slightly in advance of No. 1. This points to the fact that the comparative scalding effects of arsenite and arsenate are not proportionate to their tick-killing effects, the scalding effect of the arsenate being proportionately less than that of the arsenite. However, one cannot draw conclusions from one series of experiments. In order to prove this point a further series was carried out.

SERIES II.

Vaal and White Cow.

Ticks: Ears smothered in ticks inside and out; well infested everywhere with browns, reds, and bonts.

19th February. Dip: Arsenate 1 part, water 75 parts; sprayed in rain, some of the dip probably washed off.

21st February. Most of brown ticks dead; three male and one bont dead; not scalded.

24th February. Nearly all female bonts still alive. This unsatisfactory result is probably due to the fact that it was sprayed in the rain.

25th February. Six female and four male bonts still alive; not so good as others.

Small Black Bullock.

Ticks: Reds under tail; bonts on escutcheon and scrotum; brown in ears.

19th February. Dip: Arsenate and Emulsion 1 part, water 50 parts.

20th February. Visibly sick in evening; breathing heavily, pulse rapid: evidently suffering from arsenical poisoning.

21st February. Down and unable to rise; died about midday from arsenical poisoning, due to absorption of dip through the skin.

Red Ox.

Ticks: Bunch of bonts and one female bont-leg on escutcheon; ears smothered with ticks inside and out.

19th February. Dip: Arsenate and Standard Emulsion 1 part, water 50 parts.

21st February. Skin on legs peel off on tying with reim, purging slightly but not visibly scalded; all ticks in ears dead; most of the bonts dead.

24th February. Animal still purging but not scalded; one male and two female bonts still alive, but will probably die.

25th February. Every tick killed; animal better, no more purging and no scalding.

25th February. No more bonts dead; animal no longer purging nor blowing.

Black and White Cow.

Ticks: Browns in and around the ears; bonts on udder and at back of shoulder; well infested with reds.

19th February. Dip: Arsenite and Standard Emulsion 1 part, water 200 parts.

21st February. Ticks in ears all dead; majority of bonts dead; animal purging and blowing badly but not scalded.

24th February. Six female bonts and two males still alive; one female red alive under tail; rest all dead; animal purging and blowing badly; scalded on back and udder.

23rd February. Only one more female bont dead; others alive; animal scalded but not seriously.

Red Cow.

Ticks: Well infested with ticks.

19th February. Dip: Cooper's Cattle Dip 1—100.

21st February. All ticks in ears dead; majority of bonts dead.

24th February. Purging slightly and blowing, but not scalded; four female bonts still living, but all other ticks dead.

CONCLUSIONS.

This series of experiments was carried out to ascertain the scalding effect of sodium arsenate.

It is evident from these experiments that arsenate, when absorbed into the system of an animal in sufficient quantities, will cause death; but spraying experiments are very unsatisfactory for detecting the scalding effect of a dip.

It is necessary to use the dip much stronger than is necessary when dipping in order to detect any action upon the skin of the animal, and then, as a rule, before getting the scalding effect, the animal has absorbed so much arsenic that it dies before it shows any signs of actual scalding.

One would conclude from these experiments that arsenate has a slightly less constitutional effect upon the animal in proportion to its tick-killing effect than arsenite, for although arsenite and emulsion at 1 to 300 and 1 to 200 caused scalding, acute purging, and blowing, arsenite and the same emulsion at 1 to 100 and 1 to 75 was not nearly so injurious in its action, although the tick-killing properties of the two last dips were equally as good, if not better, than the two first. Further, the fact that one beast, No. 4, was sprayed with 1 part arsenate and emulsion to 50 parts water and suffered very little injury, although of course one cow died as a result of being sprayed

with arsenate alone in the same proportion, seems to confirm the opinion that arsenate has less proportionate injurious effect upon the animal than arsenite. At the same time it is impossible, with so few cattle, to form a conclusive opinion, as animals differ so much from one another that a dip which may not affect one animal will probably kill another. Conclusive evidence can only be arrived at by dipping a number of cattle in arsenite and arsenate at different strengths. However, in view of the fact that with dipping tanks which are constantly in use there is very little change from arsenite and arsenate, and, further, seeing that the arsenate possessed practically one-half the tick-killing power of arsenite, there can be very little deterioration in tick-killing power in a tank which is constantly in use.

In my opinion undue importance has been given to this question of deterioration of dips, and the desire on the part of farmers to have their dips tested at periodic intervals is a mistake and an unnecessary expense.

Of course it is very necessary for the authorities to make quite sure that dipping tanks are kept up to the strength, especially where owners of tanks are dipping outside cattle and are making a fixed charge per head for dipping. Some of these owners, in their anxiety to derive as much pecuniary advantage as possible, will keep their dips very much below strength, and will sometimes put cattle through a wash which is very little better than water. Such cases are fortunately few and far between, but there are a few who will stoop to this sort of thing. The offender should be dealt with in such a way as to render a recurrence impossible. The majority of tank owners, however, are far too keen on eradicating the ticks to dip in any such kind of wash merely to comply with the law, so that there is no such need for them to be watched to see that they keep their dip up to strength. The disadvantage in encouraging the testing of dipping tanks lies in the fact that farmers are encouraged to become lax and careless regarding the keeping of the measurement of the water and dip in their tanks as they know they can send it to a Government Chemist or some other official and have the dip tested without any trouble.

When carrying out tick eradication at Gonubie Park, I sometimes allowed one of the dipping tanks there to be in use for more than twelve months without emptying it, and the wash never deteriorated. The tank was accurately measured and the capacity for every 100 gallons above the 4-feet level was marked clearly on the wall. When filling the tank the water was pumped in to the 6 feet 6 inches level, the capacity of the tank at this level being known, and the requisite quantity of dip just poured into the water and stirred. After dipping, the level of the water was taken, and, again, before dipping on the next occasion, when, if the water had got in, the proportionate amount of dip was added to bring the dip up to the strength, and if the water had evaporated then more was added to bring the dip to the same level as it was when it was last noted.

The need for testing the strength of dipping will not rise if a farmer uses a dip of which the composition can be relied upon and one which will not deteriorate in the bath through oxidation. All that the farmer need do is to measure his water accurately and keep it measured. Then measure in the amount of dip required for the water in the tank. If he does this he cannot go wrong.

It is only recently that this matter of testing the strength of dips became prominent. Some farmers who have been dipping for years never found it necessary, although tanks were never emptied until they became too foul for use.

It has been stated by those who advocate periodic testing the strength of dipping tanks that the need has arisen on account of the oxidation which goes on continuously in the tank as a result of which much of the arsenite becomes changed to arsenate. Williams has proved that in a tank continuously in use very little change takes place. Further, these experiments have established the fact that arsenate is almost half as active as arsenite, so that the small amount of oxidation which takes place is of practically no account at all when considered from the point of view of the change which it effects in the activity of the dip.

Then, again, if this oxidation goes on to the extent asserted by some workers it is useless employing a method of testing the dip which does not take the arsenate into account, seeing that it is an active chemical. The error of omitting to have the dip tested is no greater than that in testing the dip by a method which does not take into account the presence of the arsenate, the only difference being that in the one case the dip will remain too weak, and in the other it will be made too strong.

The continual formation of this arsenate, if it did occur, and subsequent additions of dip to bring the arsenite up to the standard, would lead to serious results in some cases, as it would be quite possible in time to add so much arsenite that the dip would be double strength, although the percentage of arsenite is not above the normal.

The point, however, is that this oxidation has been over-rated, and, as Williams shows, it does not take place to any great extent when a bath is in constant use, hence there is no need to test a dip periodically to ascertain whether it has deteriorated in strength.

I stated above that only in very rare cases does the necessity arise for the testing of the strength of a cattle dip, i.e. provided the tank owner uses a dip of which he knows the strength, the dilution at which it is to be used, and that he takes the precaution to measure his water and keep it measured.

One of these cases occurs, however, when a tank has been left for some time without putting cattle through, and another when the tank has become flooded with rain-water above the level at which the capacity of the tank is known. Such instances can be made very rare, indeed, by (1) keeping the tank constantly in use; (2) by protecting the tank against flood water. Sometimes, however, it does occur that rains are so heavy the tank becomes flooded no matter how well it is protected. In the event of this happening it is necessary to throw out the wash until the dipping level is reached then stir the dip thoroughly, take a sample and send it immediately in a sealed bottle to the nearest Government analytical chemist.

Fly Plagues.

AN UNUSUAL OUTBREAK OF *STOMOXYS CALCITRANS* FOLLOWING FLOODS.

By Claude Fuller, Division of Entomology.

The attention of the Division of Entomology was first drawn to an unusual abundance of biting flies along the eastern seaboard of the Union by Mr. John Kirkman, of Umzinto, upon the 22nd of April. Mr. Kirkman furnished a specimen at once recognized as *Stomoxys calcitrans*, the common and practically cosmopolitan "stable fly."

On the 26th April Mr. C. B. Hill, Ginginhlovo, Zululand, forwarded specimens of *S. calcitrans*, of which he wrote: "I herewith enclose specimens of a "fly" that is making holes in animals. These I caught upon a pig's back, where they had broken through the skin and were working into the flesh. I find they break through the skin of oxen and mules, and leave ulcerous cavities. Animals cannot rest for the annoyance, and stop feeding. These creatures have only been in evidence since the floods."

Under date of 2nd May, the Senior Veterinary Surgeon, Transkei, forwarded a batch of *Stomoxys* flies for determination, the majority being the common species *calcitrans*. Concerning these he wrote:—

"These flies are attacking equines, cattle, and even sheep in the following areas, viz.:—Port St. Johns, Ngqeleni, and Lusikisiki for a distance of roughly thirty miles inward from the coast. The specimens sent were mostly secured from horses, mules, and donkeys, but include three brown ones taken from cattle. So great has been the annoyance and loss of blood caused by these flies, which buzz around in swarms, that all classes of animals have suffered greatly from worry and anæmia. Many cattle have been killed. To obtain relief, horses and cattle have stampeded into the sea and into rivers everywhere. The flies settle chiefly on the necks and legs of the animals affected. They have been intolerable in the areas mentioned for over a month, in fact since the heavy rains we experienced in March.

"I shall be glad if you will identify these specimens and give me any suggestions which will help to combat the trouble in any way. I anticipate, however, that the advent of cold weather and frost will shortly give relief to the areas now affected. I am endeavouring to supply you with further specimens obtained from different spots. Those dispatched to-day were collected by G. V. S. Keppel at Big Umgazi, Port St. Johns."

The above correspondence shows that this unusual outbreak has been of serious moment and of somewhat wide extent. The fly in question may be described as a very common species distributed all over South Africa. It is one that may be found at almost any time in and about stables and cattle kraals, although seldom of sufficient abundance to rank as a mischievous pest. In general appearance and size it much resembles the common house fly. It can always be recognized apart, however, by its small, black, rigid

proboscis. In its development it approaches that of the house fly, and is equally capable of breeding up extensively in a short space of time should the conditions it requires be present. Unlike its ally, the stable fly does not breed extensively in pure horse-dung, nor does it particularly favour pure cow-dung; its maggots require moist, decaying vegetable matter. Stable and kraal manure, with which straw is well intermixed, the accumulations of cattle kraals, and the rotting remnants of hay-stacks are its usual breeding places.

It breeds abundantly in decaying grass straw of any sort. Hence it comes about that the present unusual outbreak is directly traceable to the excessive wet weather experienced along our eastern seaboard. Such heavy rainfall, accompanied as it was by local floods, not only means a great deal of decaying vegetable matter about the farm homestead, the sugar plantation, and the kaffir kraal, but, coming as it did at the end of summer, vastly increases the opportunities for the breeding up of the insect by heaping together masses of decaying vegetable matter about vleis and along the banks of spruits and rivers, swept from the veld.

So far as our records go this is the first occasion of such an unusual outbreak of *Stomoxys calcitrans* in South Africa. Such as it is, however, it is by no means exceptional. Similar phases have been observed and studied in the United States of America, and, as in our case, all such instances have been directly traced to periods of excessive rainfall occurring towards the close of the summer season. So also have these outbreaks been accompanied by a considerable loss of stock.

With climatic vagaries, uncontrollable as they are, nothing can be done to check or prevent such occurrences: but, fortunately, they are likely to be few and far between and, when arising, more or less local.

Equally it is impossible to obviate to any great extent the accompanying loss of stock or alleviate the sufferings of animals. Especially must this be so under the conditions which obtain in South Africa in regard to native-owned flocks and herds, for it is impracticable to reduce to any extent the swarms of flies when they do occur.

Nature alone can effect a cure, and this is rapidly proceeding with the destruction and drying out of the abnormal food supplies that provided the insect an opportunity to breed up so enormously. Further, the advent of cold weather will reduce the activity of the flies and decimate the swarms.

The farmer can do little to help himself at such times, except by giving his animals such direct protection from the flies as he can devise with the means at his disposal. The use of repellant smears and sprays has often been suggested, but experiment has shown that none of these give more than temporary relief, and some of those recommended have proved injurious to the animals.

Under ordinary circumstances the stable fly can be controlled by the thorough scattering of manure which contains straw and by avoiding the accumulation of decaying hay and other vegetable refuse. Working animals can also be protected by covers and stall-fed stock by screening in their stables.

In connection with the unusual outbreaks of *Stomoxys calcitrans* experienced elsewhere it has generally been found that epidemics of disease follow the period of fly abundance.

It is stated that in redwater areas native and immune cattle break down to the disease. This is attributed to weakness and anæmia, following the attack of the flies. The fly is also charged with transmitting glanders from diseased to healthy horses and anthrax amongst cattle, acting not as an intermediate host of the disease but as a direct carrying agent. Similarly it has been shown that epidemics of infantile paralysis usually occur with an abundance of the stable fly.

ANOTHER FLY PEST.

Following closely upon the report of the excessive abundance of the stable fly a further complaint regarding an entirely different fly has reached the Division from Senior Veterinary Surgeon of the Transkei. Writing under date of the 16th May, Mr. Spreull says:—

"I am posting you to-day under separate cover four flies brought in by Sheep Inspector Adams. He obtained these from sheep at Mevana, on the Libode—Port St. Johns border. This fly he found fully gorged with blood, and attacking sheep in the neighbourhood of fly-blown sores. The natives believe this fly to have deposited its maggots in the sores, but I think this unlikely, the blow fly being the most likely offender in this respect. The sores on the sheep are said to form as a lump which bursts or is broken by the sheep rubbing or biting, and then the wound becomes fly-blown. So far, I have not been able to ascertain the primary cause of the formation of these lumps or swellings. Many sheep, both old and young, are dying from this cause, and the natives are too penurious, apathetic, or lazy to carry out any treatment suggested to them by the sheep inspectors or local Europeans. The simultaneous dipping now being carried out is having a good influence, however, in checking it. Horses which have died lately in that neighbourhood (presumably from horse-sickness) have been found to have their ears full of this fly and blood oozing from their bites."

As stated, the fly in question is altogether different from the stable fly, being a gnat of the genus *Simulium*. These gnats are also known as "sand flies" and "black flies." As with the stable fly, they are periodic pests of stock in other parts of the world. In the Southern States of America one species known as the Buffalo gnat has an unenviable reputation, and in Hungary a similar insect is recorded as doing much damage to all kinds of live stock. It is stated that: "There the gnats appear every spring in varying numbers, forming local swarms which move about with the wind, but no general invasion takes place until the river Danube inundates the region infested." This would indicate that there is some connection between floods and an excessive abundance of *Simulium*; but if the gnats are now excessively abundant in the district from which the complaint comes it is much more likely that the excessive rains have provided more extensive breeding grounds for them or at any rate given them greater opportunities to increase and multiply because, like mosquitoes, they are aquatic in their earlier stages. A number of different species of *Simulium* exist throughout South Africa, but outbreaks must be regarded as very rare, and swarms are not extensive and very local.

One species is a constant pest to poultry in environments favourable to its propagation about Capetown and in many parts "sand flies" are well known. The adult gnats deposit their eggs upon

stones and other objects in the beds of shallow-running streams, the female crawling down into the water enclosed in a bubble of air to accomplish the feat of egg-laying. The larvae attach themselves to stones, sticks, and leaves, and feed by the aid of peculiar jaw-like organs; in short, they spread their nets as does a fisherman. The pupa stage is also passed under water, the creature for the time being inhabiting a shoe-shaped cocoon.*

The control of the insect in its earlier stages is quite impracticable, and stock can only be protected by burning smudges and by smears.

Apart from the great irritation set up by the bite of these gnats, it is also thought to have a poisonous effect, and this may account for the swellings noticed to follow their bites upon sheep both here and in the Soudan.

Similar gnats have been associated with the disease "Pallagra," of Southern Europe, and it is recorded that German veterinarians have shown that they are the cause of serious disease in cattle.

Experiments in Dry-Farming.

RESULTS FROM LICHTENBURG.

IN view of the interest taken in the work of the Dry-Land Station at Lichtenburg, it was thought desirable to publish the results as soon as obtained, although they will also appear in due course in the Annual Report of the Dry-Land Agronomist.

THE RAINFALL.

The following statement shows the monthly rainfall during 1912 at Lichtenburg:—

1912.	Inches.		No. of Days.
January	2·70	on	8
February	5·77	„	12
March	4·39	„	13
April	3·43	„	10
May	0·90	„	3
June	0·00	„	—
July	0·10	„	1
August	0·00	„	—
September	0·00	„	—
October	0·31	„	3
November	0·10	„	2
December	4·46	„	13
TOTAL	22·16	„	65

* See *Cape Agricultural Journal*, p. 29, January, 1899.

GOVERNMENT DRY-LAND EXPERIMENT STATION, LICHTENBURG.

STATEMENT OF EXPERIMENTS ON CROPS HARVESTED IN 1912.

Variety.	Rate of Seeding (per English Acre).	Time of Seeding.	No. of Acres Planted.	Time of Harvesting.	Average Yield (per English Acre).	Remarks.
(1)						
SOYA BEANS ("Sakura").......	40 lb..........	28th Dec., 1911	5	End of April, 1912	209½ lb.	Badly damaged by hail on 20th February, 1912.
SOYA BEANS ("Sakura").......	40 lb..........	15th Jan., 1912	5	During last week in May, 1912	815 lb.	This crop was on another portion of the farm and escaped the hail, partly. No manure or fertilizer was used.
(2)						
POTATOES ("Northern Star")..	900 lb...... ..	9th, 10th, 13th, 14th Nov., 1911	4	May, 1912.........	6,000 lb.	This crop was several times badly damaged by hail. A previous year the same variety yielded 9,750 lb. to the acre. Two trolley loads of kraal manure (per acre) incorporated 1912 crop.
(3) MAIZE.						
"Hickory King...............	10 lb.........	20th, 21st, 22nd, 23rd Nov., 1911	20 } 70 Acres..	June, 1912........	1,400 lb.	The land on which the maize crop has been grown is very sandy and extremely poor in natural fertility, with a sub-soil of ironstone gravel. No manure or fertilizer was used. We have, this year, planted more varieties.
"German Yellow"............	10 lb.........	27th, 28th, 29th, 30th Nov., 1911	20		1,150 lb.	
"Iowa Silver Mine"..........	10 lb.........	16th, 18th, 19th, 20th Dec., 1911	20		650 lb.	
"Bishop" (Yellow)...........	9½ lb..... ...	5th, 6th Dec., 1911	5		980 lb.	
"Minnesota King"............	9½ lb.........	4th Dec., 1911	2½		860 lb.	
"Funk's 90 Days"...........	10½ lb....	8th Dec., 1911	2		655 lb.	
"Drought Proof".............	5 lb..........	15th Dec., 1911	½		388 lb. per ½ acre	
(4)						
TEFF GRASS..................	5½ lb........	15th Nov., 1911	4	April, 1912........	1 ton (with straw)	The quality of seed was poor and the germination was not very good. No manure or fertilizer used.
(5)						
LINSEED (Flax)...............	5 lb..........	14th Nov., 1911	½	April, 1912........	108 lb.	The demand for seed of this variety is great, consequently we have sown more extensively this year. No manure used.

(6) **Butter Peas** (York)	45 lb.	6th Feb., 1912	2	May, 1912	255 lb.	No manure used. Demand for green and dry peas locally.
(7) **Millets.**						
"Japanese"	10 lb.	16th Nov., 1911	1	April, 1912	1¼ ton (with straw)	No manure or fertilizer used.
"Golden"	10 lb.	16th Nov., 1911	1	April, 1912	½ ton (with straw)	
"Boer"	10 lb.	18th Nov., 1911	8	April, 1912	1½ ton (with straw)	
(8) **Sunflower** (Russian)	8 lb.	2nd Jan., 1912	1	May, 1912	345 lb.	No manure used. These sunflowers stop "sand-drifts" when planted in "screens" round the fields or acre plots.
(9) **Cowpeas**	40 lb.	2nd Jan., 1912	5	Ploughed under	as green manure	Maize planted on these plots this year.
(10) **Vicia Villosa** (Vetches)	18 lb.	31st Dec., 1911	5	Ploughed under	as green manure	Soya beans planted this year.
(11) **Lupines** (White)	50 lb.	3rd Jan., 1912	15	Ploughed under	as green manure	Maize planted this year.
Lupines (Yellow)	5 lb	4th Jan., 1912	15	Ploughed under	as green manure	Peas, potatoes, barley, and linseed planted.
(12) **Velvet Beans**	60 lb.	5th Jan., 1912	1	Ploughed under	as green manure	Summer wheat planted this year.
(13) **Kaffir Beans**	45 lb.	12th Dec., 1911	1	Ploughed under	as green manure	Maize planted.
(14) **Barley.**						
"Austrian"	45 lb.	8th July, 1912	1	30th Nov., 1912	1,050 lb.	Soil rather alkaline. No manure.
"Boer"	45 lb.	8th July, 1912	2	Cut as green forage for animals in Oct. and Nov., 1912	—	Average yield previous years was 1,125 lb. to the acre.

Variety.	Rate of Seeding (per English Acre).	Time of Seeding.	No. of Acres Planted.	Time of Harvesting.	Average Yield (per English Acre).	Remarks.
(15) WHEAT, viz.: "Chernouska" (Durum).......	37½ lb.........	9th May, 1912	1	5th Nov., 1912.....	322 lb.	300 lb. of special wheat fertilizer used. The straw of this crop was long and heavy, but crop was badly damaged by frost during its flowering stage, hence the small grain yield.
"Chernouska" (Durum)........	37½ lb.........	2nd July, 1912	5	28th Nov., 1912.. .	1,028 lb.	Somewhat damaged by frost during flowering stage. Lupines grown and ploughed under previous year. No manure used.
"Chernouska" (Durum)........	37½ lb.........	27th July, 1912	5	Destroyed by hail,	20th Dec., 1912	Three trolley loads of kraal manure incorporated (per acre). This crop was excellent, both in grain and straw, and was just ripe when hail-storm came.
(16) "Minnesota" Wheat (Soft).....	37½ lb.	22nd July, 1912	5	Destroyed by hail.	20th Dec., 1912	Special wheat fertilizer (300 lb. per acre). This crop was good in grain and straw.
"Minnesota" (Soft)......... ..	37½ lb.........	11th May, 1912	2	6th Dec., 1912.....	980 lb.	This variety resists frost fairly well, but has nevertheless suffered severely. No manure used.
(17) "Federation" (Soft Var.)......	37½ lb.........	24th July, 1912	2	Destroyed by hail.	20th Dec., 1912	Two trolley loads kraal manure (per acre), incorporated crop was rather promising.
"Federation" (Soft Var.)......	37½ lb.........	1st July, 1912	1	9th Dec., 1912... .	1,015 lb.	Legumes ploughed under previous year. No manure.
(18) "Polish Wheat" (Durum)	35 lb..........	15th July, 1912	1	18th Dec., 1912.. .	809 lb.	Maximum yield per acre (1910) was from Beloturka, also a durum. No manure.
(19) "Kubanka" (Durum).........	37½ lb.	3rd July, 1912	1	End Nov., 1912....	1,018 lb.	Three trolley loads of kraal manure incorporated (per acre) in December, 1911. Crop suffered through untimely frost.

(20) OATS.						
"Algerian"	70 lb.	2nd April, 1912	1	6th Nov., 1912	1,892 lb. (with straw)	No manure. Wheat was harvested previous year.
"Sidonion"	79 lb.	2nd April, 1912	1	6th Nov., 1912	1,771 lb. (with straw)	No manure. Wheat was harvested previous year.
(21) RYE	45 lb.	3rd April, 1912	3	Cut as green forage for animals during drought	—	This crop did not suffer through drought, but it was not at all good looking. The soil is somewhat strongly alkaline.
(22) PEA NUTS ("Virginian Mammoth")	100 lb.	27th Dec., 1911	1	May, 1912.	1,065 lb.	Not having the proper pea nut digging machinery, it is impossible to get all the nuts out of ground. No manure used.
(23) LUCERNE ("Provence")	15 lb.	Mar., 1910	2	Three cuttings	per season	No manure. Soil somewhat alkaline (sodium carbonate).
(24) SAINFOIN ("Ornobrychis Sativa")	5 lb.	Mar., 1910.	$\frac{1}{2}$	Poor animals kept winter	on during part of	No manure. Soil alkaline. This variety is a good winter feed and does fairly well on dry-lands.
(25) PHALARIS BULBOSA (Grass)	Roots planted..	Mar., 1911..	$\frac{1}{4}$	Cut as green forage during winter months	—	Grows well on dry-lands and is an excellent winter grass. No manure.
(26) COTTON (Cook's "Long Staple") CORIANDER GINGER	Successfully grown on small plots		—	—	—	These varieties will now be grown on larger scale. Coriander and ginger in great demand by Indian community (locally)
(27) CLOVER (Different Varieties) BEGGER WEED *Bromus Inermis*	These varieties were tried for two		consecutive years with little or no success		—	Soil evidently not suitable.

Variety.	Planting (per English Acre).	Time of Planting.	No. of Trees Planted.	Time of Harvesting.	Average Yield (per English Acre).	Remarks.
(28) TREES (Forest). *Eucalyptus viminalis* *Eucalyptus rostrata* *Eucalyptus robusta* *Eucalyptus stuartiana* *Callitris robusta* *Cupressus arizonica* *Acacia cultriformis*	1,250 per acre, or on 6 ft. squares	Jan. to April	—	—	—	We have every year planted a number of trees; in all about 16,000, viz.: hedges, windbreaks, etc. We have trouble with white ants, but for the rest the trees grow well. The fast-growing Stuartiana and Viminalis are great frost resistants, especially the first named.
(29) FRUIT TREES (Apples) "Monroe's Favourite" "Senator" "Versveld"	25 ft. squares, viz.: 25 ft. in row, and rows 25 ft. apart	July and Aug., 1911	300	—	—	These trees are growing well on drylands and had fruit on this year (1912), which was beaten off by hail, 20th December, 1912.
(30) SPANISH REEDS	Planted in hedge	300 yds long	—	—	—	Growing well.
RAINFALL, 1912	January, 1912 ... 2·70 in. February, 1912 ... 5·77 in. March, 1912 ... 4·39 in. April, 1912 ... 3·43 in. May, 1912 ... 0·90 in. Before sowing ... 17·19 in.		*Period of winter crops* June, 1912 ... Nil July, 1912 ... 0·10 in. August, 1912 ... Nil September, 1912 ... Nil October, 1912 ... 0·31 in. *November, 1912 ... 0·10 in. December, 1912 ... 4·46 in. Growing period of wheat crops ... 4·97 in.			* *N.B.*—On 15th November, 1912, 0·03 in., and on 16th November, 1912, 0·07 in. of rain fell. FROST WAS REGISTERED.— *September* (1912).—From 1st to 17th every night; also on 21st, 22nd, 23rd, 24th, 26th, 27th, 28th, 29th, and 30th. *October* (1912).—1st, 2nd, 4th, 5th, 6th, 7th, 8th, 11th, 12th, 13th, and 14th. *November* (1912).—10th, 11th, 20th, 26th, 27th, and 28th. *December* (1912).—Light frost 22nd, 23rd, and 27th.

A New Sugar-Cane Pest.

THE following somewhat alarming telegram was received on 12th May by the Division of Entomology from Mr. W. Campbell, Natal Estates, Mount Edgecombe:—

> "Some 12,000 acres of canes suddenly attacked by grub. Almost every individual cane top has a grub in it, irrespective of age of cane. We are much alarmed; please send officer to inspect."

This matter was at once taken in hand and an investigation of the trouble made by the Assistant Chief of the Division. The report given by Mr. Fuller to Mr. Campbell, which will no doubt be of interest to cane-planters generally, was as follows:—

The insect in question is a moth caterpillar which webs together the immature leaves forming the spike of the cane and, living within the protecting tube so formed, feeds upon the inner surface of the outer leaf forming the spike.

It feeds in a peculiar manner, eating along the leaf fibres so that its injury takes the form of numerous parallel grooves in the leaf-surface. The insect displays no tendency, so far as I have yet been able to see, either to work downwards towards the growing apex of the spike or to eat through the leaves. None of the caterpillars found being fully grown, it is not possible to say whether or not some more serious aspect may intervene before the caterpillar stage is finished. The evidence I was able to collect leads me to the conclusion that such will not be the case, and that the attack will be no more serious in the long run than the condition at present evidenced.

The observations which lead me to this satisfying conclusion are as follows:—

1. It is a striking feature of the attack that, in the first place, every spike or at least 99 per cent. of the spikes of the "Uba" cane are infested.
2. In the case of every spike so infested it is the exception to find more than one caterpillar within it.
3. The sweet canes represented in this case by "Black Seedling" and "Green Cane" are practically immune from attack, no matter how adjacent to grossly infested areas of "Uba."
4. The preference of the insect for "Uba" is strikingly illustrated where individual stools of this variety are standing in blocks of the sweet cane.

Taking the case of the attack upon the "Uba" variety first, I may say that I was unable to recognize any very serious damage. Certainly there must be a degree of depreciation brought about partly by the destruction of a certain amount of leaf-tissue and also by the delayed activity of the enfolded leaves, but this is, fortunately, of so minor account, that you can safely disregard it.

In the case of the "Uba" cane the insect's chief influence is to prevent the normal unfolding of the leaves from the spike. It was

obvious, however, that the plant forces were always sufficiently strong to break away the silken weft of the caterpillar, and the leaf upon which it had been feeding ultimately unfolded.

In the case of every infested spike of "Uba," where the process just described was either quite evident or accomplished, I found that the caterpillar transferred its quarters to the next leaf sheathing the spike. It is this feature which led me primarily to the optimistic conclusion that the effect of the pest will be of minor account.

In making the statement that it is the exception to find only one caterpillar to the spike, I wish to say that all the spikes which I examined contained but one caterpillar, but your field manager stated that he had found two or three in some cases.

With regard to the sweet canes which I have enumerated, their immunity was most pronounced, but this, to my mind, has nothing to do with their unsuitability as a host plant. To a very small extent they are attacked, but they owe their comparative freedom to a purely mechanical factor, or, in other words, to the nature of their growth. These varieties, together with one other of which I saw but one stool—"China Cane," possibly—do not form so long and enfolded a spike as does the wilder "Uba." As a consequence they do not afford a suitable environment for the caterpillar. Further to this the leaves are more erect and less pliant—in other words, they are less easily woven together by the small caterpillar and so they do not lend themselves to the insect's manœuvres. Added to this, the plant forces are apparently stronger, per cane, and the leaves tear away the weaving of the caterpillar with greater ease.

I am led to these conclusions by observing the fact that in such cases as fell under my observation the attacked leaf, in carrying itself away from the spike, transported the caterpillar with it, and it was quite obvious to me that the insect was much put to it to maintain its position. Naturally, under this set of circumstances, the caterpillar becomes more exposed and more open to the raids of any given enemy. I think there is little doubt that this is the case because evidence of the prior presence of caterpillars upon the foliage of these sweet canes was more abundant than were the caterpillars, whilst in the case of the "Uba" variety, evidence and caterpillars marched hand in hand.

The control of the insect at present does not call for serious consideration, but should it ever do so it will be most difficult to suggest any practical measure which can be contemplated with equanimity.

The caterpillar feeds in absolute seclusion; it could never be poisoned. At the moment of my visit the pest could have readily been exterminated by cutting out the infested spikes. But what does such a proposal mean? In the first place it means the wanton destruction of 90 per cent. of the leaf-surface that the plant is in the process of putting forth. I say 90 per cent. because the damage done by the caterpillar can be safely regarded as only 10 per cent. of this potential foliage. For this reason alone such a treatment will give a greater "set back" to the growing plant than the insect is capable of. Of course such cutting out is "practical," and one has frequently seen cutting out the infested hearts recommended for sugar-cane insects. The economy of such a treatment depends upon the damage done.

Over and over again cane-planters have desired the introduction of canes from abroad, and as strenuously I have opposed them. Of

course canes have been introduced in spite of my endeavours to prevent them. Whether with ill-effect or not with respect to destructive insects and fungi time alone will show. Sugar-cane in Natal is, to-day, so far as I am aware, exempt from any serious "borer" attack. Because there are many serious cane borers (some capable of destroying 80 per cent. of the canes)* which can be easily introduced, you will forgive me if I give you some idea of what is involved in their control should an infestation of borer equal to or approaching that under discussion eventuate in your cane fields.

I understand that the bulk of your estate is under "Uba" cane. Assuming that this spike-roller has to be controlled by cutting out, and that only 8000 of the 11,000 odd acres are under "Uba," the cost of cutting out in, say, eighteen months' old cane would be about £4000.

I arrive at this figure on the following basis:—

(*a*) The cane is set 5 feet by 3 feet.
(*b*) There are about 15 canes to a stool (some stools, I know, run 20-30, and even more).
(*c*) It takes a coolie 5 seconds to cut out a spike. Working for twelve hours a day continuously he will take at least 10 seconds per spike.†
(*d*) His wages are 1s. per diem.
  (*a*) 1 Set (5 feet by 3 feet) to 15 square feet is 2904 sets to the acre.
  (*b*) 2904 Sets, with 15 canes each, is 43,560 canes.
  (*c*) 43,560 canes, at 10 seconds each, is 435,600 seconds or 121 hours, otherwise 10 days.
  (*d*) That is 10s. per acre for labour in cutting alone.

On 8000 acres, therefore, it resolves itself into an expenditure of at least £4000 within a short period, and at least the putting on of 8000 hands to accomplish the work in the required space of time.‡

* It is stated authoritatively in the *Agricultural Journal of India* (April, 1908) that the cane shoot borer of Behah (*Scirpophaga auriflua*): "in some seasons, favourable to the development of this insect, it is probable that at least eighty per cent. of the cane crop is affected by it."

† It is not to be assumed from these remarks than coolies do work twelve hours a day for one shilling per diem.

‡ It is to be noted that in these calculations no account has been taken of such items as supervision, removal from the fields and destruction of infested parts, cost of knives, etc.

Government Stock at Rosebank.

PRIZE-WINNING ANIMALS AT ELSENBURG.

The following is a list of stock from the Experiment Farm at Elsenburg which secured prizes at the recent Rosebank Agricultural Show:—

Dutch Cattle.

Best bull calved in 1905-1908, "Lord of Gloria," first.

Best South African-bred bull calved in 1905-1908, "Lord of Gloria," first.

Best bull calved in 1909 or 1910, "Buterblom," first.

Best bull calved in or subsequent to 1911, "Royalist," highly commended.

Best heifer calved in or subsequent to 1910, "Victory," third.

Best South African-bred heifer calved in or subsequent to 1910, "Victory," third.

Best South African-bred cow calved previous to 1910, "Roma," very highly commended.

Any other Heavy (pure) Breed.

Best cow calved previous to 1910, "Helen," first.

Best South African-bred cow calved previous to 1910, "Helen," first.

Jersey Cattle.

Best bull calved in 1905-1908, "Speculator," highly commended.

Best bull calved in or subsequent to 1911, "Guard of E," first.

Best heifer calved in or subsequent to 1910, "Gertrude of E," first.

Best South African-bred heifer calved in or subsequent to 1910, "Gertrude of E," first.

Best pen of three South African-bred heifers calved in or subsequent to 1910, "Gadfly of E," "Gamp of E," and "Goddess of E," very highly commended.

Best cow calved previous to 1910, "Fanny," first; "Glee," very highly commended.

Best South African-bred cow calved previous to 1910, "Fanny," first; "Glee," very highly commended.

Group Classes.

Heavy Breeds: "Buterblom," "Roma," "Beauty," "Victrix," and "Victory of Elsenburg," first.

Light Breeds: "Speculator," "Guard," "Gertrude," "Fanny," and "Glee," second.

Championships.

Best bull of any heavy breed (Rhodes Memorial prize), "Lord of Gloria."

Best South African-bred bull of any heavy breed (Rhodes Memorial prize), "Lord of Gloria."

Best bull of any light breed (Rhodes Memorial prize), "Guard of E."

Best South African-bred bull of any light breed (Rhodes Memorial prize), "Guard of E."

Best South African-bred cow or heifer of any light breed, "Fanny."

Governor-General's prize for best exhibit of cattle on the show.

Rural Notes.

Importation of Pedigree Stock.

The conditions concerning free freight for pedigree stock in the mail or intermediate ships of the Union-Castle Steamship Company, Limited, or other ships named by the company, from the company's berth ports or from other ports in Great Britain at the option of the company, to any of the company's usual ports of discharge within the Union of South Africa and to Lourenço Marques, have now been gazetted. It is provided that the term "pedigree stock" shall include stallions, mares (excluding racehorse mares), bulls, cows, boars, sows, rams, and ewes for breeding purposes. The term "free of freight" includes accommodation and supervision equal to that for which freight is paid, under ordinary circumstances, but not food, which will be provided by the company at the cost of the shipper at the following scale of charges to all ports: For stallions and mares, bulls and cows, £4. 15s. per head; boars and sows, rams and ewes, £1. 7s. 6d. per head. These charges must be paid by the shipper on booking the animals. The stock will be carried at owner's risk from f.a.s. (free alongside) until landed at the port of destination. Should shippers desire to provide veterinary or special attendance of freight-free stock, such can be done on special terms to be arranged with the company. The pedigree stock must be registered in the stud, stock, or herd book of the different societies or other recognized public association approved by the High Commissioner and of which a list is kept in his office. If the High Commissioner approves of the stud, stock, or herd book in which the pedigree stock is registered, he will certify to that effect to the company in the following form:—

This is to certify that the..
is recognized by the Royal Agricultural Society and approved by the High Commissioner.

This certificate is furnished in respect to......................
...
shipped by..

....
Secretary.

Office of the High Commissioner for the Union of South Africa.

A pedigree of each animal, signed by the breeder and duly attested by at least one credible witness, and certified by the authority of the stud, stock, or herd book in which the animal is entered, should be attached to the application for free freight and produced to the company with the High Commissioner's certificate. In the case of animals of the equine species, a certificate by a qualified veterinary surgeon must accompany the pedigree to the effect that the animal is free from hereditary disease.

A veterinary inspection of all animals will be made at the instance of the company immediately prior to shipment, and a fee of two shillings and sixpence will be charged therefor in respect of each

free-freight animal. As long as the prohibition imposed by the British Government on the calling at a British port of vessels carrying cattle from the Continent of Europe remains in force, the company cannot load at Continental ports stock so prohibited, but if the company has boats sailing direct to South Africa from Continental berth ports it will convey such stock free of freight in accordance with these conditions. The company will arrange for vessels to call specially at a Dutch port about three times a year after leaving London, provided at least 100 head of pedigree cattle are booked for each shipment in accordance with these conditions. Stock imported free of freight may not be removed after their arrival within the territory of the Union of South Africa to any place or country outside the limits thereof during a period of less than three years, nor may such stock be re-exported. Free freight will not be granted by the company for pedigree stock intended for the Bechuanaland Protectorate, Swaziland, or Basutoland until they are incorporated in the Union of South Africa. The Union Department of Agriculture has the right to request the company not to carry free of freight any animal or animals even though possessing the prescribed pedigree.

Florida Grass for Poultry Runs.

Mr. R. Bourlay, the Lecturer in Poultry at the Potchefstroom School of Agriculture, writes: On or about the 15th of January, 1913, we planted Florida grass in two of the poultry runs at the Experimental Farm, Potchefstroom, as an experiment, with the object of ascertaining whether the birds would consume it readily, and also to see whether, with care and watering, it would keep green during the winter. The roots were planted after a good rain while the ground was thoroughly moist and loose, each of these being about four inches apart. The runs were empty at the time, and no fowls were placed in them until the middle of April, by which time each block which had been planted was one solid mass of lovely green, fine grass. This the birds eat readily, and appear extremely fond of. At the time of writing, although the area of grass in each run is but a small one and the birds spend most of their time on it, it is still quite green and is growing well in spite of the absence of rain or irrigation. Shortly it is intended to commence watering the grass every week, and this will be continued during the dry winter months with the object of ascertaining whether a supply of green food can be maintained through the winter, and results of this experiment will be published in due course; but whether or no this latter part of the trial gives the desired result, there can be no doubt that Florida grass is eminently suitable for planting in poultry runs, as it is fine in texture, very tender, and sweet. The best time for planting it is during the spring; the ground should be well loosened and watered; the birds should not be allowed to use it until it has had a chance to get thoroughly established. Residents of Johannesburg who do not know this variety of grass have only to visit the Zoological Gardens where the beautifully kept lawns are all planted with it.

An Exhibition of South African Products.

The South African National Union asks us to intimate that it is proposed to signalize the official opening of the Union Government Buildings at Pretoria next year by holding a big exhibition of South

African products, manufacture, minerals, and raw materials on a scale worthy of the greatness of the occasion. During its existence the South African National Union has made many efforts to stimulate the exploitation of South Africa's natural resources, and has consistently laboured to popularize home-made products and manufactures. It has been the means, very largely, of diminishing the prejudice against articles produced and manufactured in this country, and by its advocacy has encouraged South African producers to improve the quality and character of their products. Real and substantial progress in this direction has been made, and it is now felt that the good work already done should be extended and enlarged. But the success of the society's project cannot be looked for unless South Africans of all classes and of every profession and trade loyally co-operate to render what help they can to enable the object to be carried out. Unfortunately, there still prevails some supineness on the part of producers to make the most of the natural gifts with which the country is richly endowed, and the community suffers by the failure to turn to profitable account this latent wealth. South Africa is blessed with great wealth and variety of raw material, but so long as it remains an unknown quantity the presence of such raw material confers no benefit.

At the Pretoria Exhibition it is especially desired that every available description of raw material which the country possesses should be displayed. At the opening of the Mining Exhibition held in Johannesburg in April, under the auspices of the Chemical, Metallurgical, and Mining Society, the chairman complained of the very poor response made to their invitation to exhibit specimens of raw products. At the exhibition now proposed it is hoped that every form of product will be thoroughly represented. Complaints are heard that no new capital is coming into South Africa, and that our youths are being educated along lines that lead to blind-alley occupations. It is only by advertising our resources and industrial possibilities that we can hope to widen the sphere for the investment of capital and the employment of white labour. Certainly an excellent means of forcing on the public mind the latent advantages our country possesses for the establishment of new and highly profitable industries is by such an exhibition as it is proposed to hold at the Administrative Capital. Last year the Manufacturers' Association of Australia celebrated a "Manufacturers' Day." In Sydney, where fifteen years ago nothing but imported goods were seen in the shops, over 1000 shops had their windows dressed exclusively with articles of Australian production and manufacture. In Canada a "Manufacturers' Train" traversed the Canadian continent, specially fitted out with goods of Canadian manufacture. And it is said that over 250,000 persons visited this train on its journey from east to west to view the exhibits it carried. At Capetown in 1908 the South African Manufacturers' Association held a highly successful exhibition of South African products and manufactures, when over 60,000 people passed through the turnstiles, in addition to nearly 20,000 children. The South African Manufacturers' Association proposes to hold a similar exhibition at Capetown early next year, so that public opinion may be better informed of the actualities of the manufacturing industry in South Africa.

It is only by public exhibitions of this kind that the real merits of the national work the manufacturers' associations are doing are brought before the public eye. The South African National Union contemplates holding its exhibition in Pretoria about the middle of next year. The Agricultural Society has placed its grounds and buildings at the service of the South African National Union, and the accommodation will in the interval be increased. It rests with the producing and manufacturing interests of this country to make the exhibition the biggest thing of the kind ever attempted in South Africa. In this connection, farmers and prospectors in every part of the country can help by exhibiting samples of raw products of all kinds. It is desired that samples of every product the soil produces should be displayed, as well as articles manufactured therefrom. Every indigenous thing of known commercial value, or likely to be of a character that may be utilized in the industries of the country, may be exhibited. The occasion lends itself to a great national exhibition of South Africa's resources, of its pastoral and agricultural products, its mining and commercial enterprise, its manufacturing and industrial activities, its wealth and variety of raw material. It is hoped that manufacturers, and indeed all those interested in the progress of the country will support both the schemes mentioned, as well as the "All South African Week" to be held sometime this year. It is only by continual effective advertisement that any commercial scheme, or new country, can ever hope to keep itself before the public eye. The South African National Union realizes that a large number of manufacturing industries are, and will probably remain, at the coast, both at the Cape and Natal. The Pretoria Exhibition, which will be visited by thousands of people from Johannesburg and other parts, will afford an excellent opportunity of bringing the goods of the coast manufacturer to the notice of the up country consumer, who after all is the person whom it is largely desired to reach. By means of these two exhibitions, and the "Week," nearly every one in the Union will become acquainted with the advance made in local industries during the past few years, and farmers and others will be brought to realize the number of industries that it will be possible to establish as soon as supplies are available in sufficient quantity and of suitable quality. Too much emphasis cannot be laid on the fact that, although local industries have made considerable strides, despite many drawbacks, no large development can take place until there is evidence that there will always be constancy of supply as well as uniformity of quality. Broadly, the efforts referred to are intended to be educative, which is of course the purpose of all exhibitions of this character.

Protection from Hail.

Mr. B. C. R. Langford writes:—Attention in this country has been directed to the system of "Electric Niagaras" or "Parahails," now extensively used in France for the protection of crops, mainly, I believe, by a descriptive pamphlet issued by Mr. A. Karlson, M.I.C.E., in collaboration with the writer, and subsequently by an article appearing in this journal. As during the past year many

inquiries have been received by the compilers of the pamphlet referred to, the following account may be of interest. Into the various theories to account for the formation of hail it is unnecessary to enter, but certain facts are evident. Hailstorms only occur in a relatively dry atmosphere and during an electric storm—there can be electric disturbances without hail, but no hail without electricity. Electricity, therefore is an active agent in the production of hail. Hail can be prevented or dissipated: (1) By saturating the air with moisture; (2) by diminishing or suppressing the atmospheric electricity. The first method may be considered impracticable, though afforestation may perhaps lead to this result; the second has been found to be possible by means of exceptionally powerful lightning conductors of a peculiar shape, the invention of MM. Le Comte de Beauchamp and General de Negrier. These "Niagaras" serve to unite the positive electricity of the cloud with the negative electricity of the earth; the intensity is thus lowered and hail is either not formed at all or falls harmlessly in a soft state. The general direction or trajectory of the storms in a particular district having been previously studied, the line of "Parahails" is placed at right angles to it. The interval between posts varies with circumstances. The area protected appears to extend for 2 to 3 miles down wind and for about ⅝ mile up wind of the line of posts. The amount of protection afforded, however, varies with the intensity of the storm; the greater the intensity the more protection. For the erection of these posts the presence of either permanent surface or sub-soil water is absolutely necessary. In France the height of the structure carrying the "Parahail" varies from 36 metres to 40 metres or more. Here it is believed the minimum height must be 130 feet. The supporting structure is usually a steel lattice-work tower; but church spires, etc., are utilized. When the country is hilly natural eminences can be made use of and the height of the steel tower thus be reduced. The cost of a complete instalment in France is:—Tower, 130 feet, 2800 francs; electrical material, 1100 francs; embankments, 100 francs—total, 4000 francs—say, £170; to this must be added the cost of trenching and excavation.

It is now nearly twelve years since the first "Niagara" was installed by M. De Beauchamp, and the system is no longer in the experimental stage. Sixty-one posts have actually been erected and eleven others are in course of erection. All this is being done under the direction of the "Comte de defense contre la grele," a purely scientific and advisory body, which makes a special study of the subject and carries out investigations and gives advice and information to inquirers. The patents of the invention being held by the society, it is able to prevent any unscientific or unauthorized use of it. A similar society is now being formed in the country, and a provisional promise of all the rights of the French society has been obtained. Mr. Karlson is now in France to confer with the French society, and if the project meets with sufficient support it is probable that at least one line of "Parahails" will be erected before long. The writer has a considerable amount of information on the subject in the shape of statistics and the latest reports, and will be pleased to answer any questions either through the journal or directly.

Sources of Nitrogen.

Mr. J. S. Jamieson, F.I.C., F.C.S., Government Chemist (Natal), Durban, writes:—If a country's assets are to be gauged by its agricultural products, which are more stable than its mineral wealth, then it behoves us to use the latest scientific methods for bettering the conditions of agriculture in the land. It is well known that the fertility of cultivated soils is dependent on the amount of combined nitrogen added as a manure or fertilizer; of course, cultivated soils require fertilizers containing other elements, particularly phosphorus and potassium, but nitrogen is the most expensive. The nitrogen generally used for this purpose is in the form of sodium nitrate. The bulk of sodium nitrate used as a manure comes from Chili and Peru. In 1873 the nitre beds of these places extended over 550,000,000 square miles and were estimated to contain 4,000,000 tons per square mile, yet the consumption is so great that it was predicted the beds would be exhausted in less than a century. Since the comparatively small store available promises soon to be deplenished it is obviously necessary to exploit other means of supplying agriculturists with the fertilizers they require.

There are at present two promising methods for the fixation of atmospheric nitrogen in a form available for plant food, viz.:—(1) By heating calcium carbide in dry nitrogen whereby it is converted into calcium cyanamide; (2) the direct oxidation of atmospheric nitrogen and absorption of the resulting oxides in water or alkaline solution. Let us deal with the latter method first. Siemens and Halske burnt the nitrogen by passing air through a chamber containing an electric arc spread over as great a surface as possible by means of an electro magnet. Nitric oxide is first formed to the extent of 1 to 1.5 per cent.; these gases then enter a chamber where the lower oxide combines with the oxygen of the atmosphere to form the higher oxide, namely, nitrogen peroxide. The gases are then passed through a series of five absorption towers where they meet water and milk of lime. The absorbed nitrogen oxides form nitrate of lime. This process is largely carried out in Norway. The resultant calcium nitrate contains nearly 13 per cent. available nitrogen. In 1909 Norway produced 9422 tons of this substance by this process valued at £72,600. Ordinary sodium nitrate containing about 15 per cent. of available nitrogen is approximately worth £14 per ton. The first process, namely, the preparation of calcium cyanamide was patented in 1895 and consists in the fixation of atmospheric nitrogen by heating calcium carbide in an atmosphere of nitrogen to between 1000° and 1100° C. The mixture is known in commerce as nitrolime, and is used both as a fertilizer and in the manufacture of cyanides. The previously mentioned method on account of its comparative simplicity and probable low cost might be readily taken up in South Africa. It is well known that the power from the two great waterfalls, namely, Victoria and Howick, have been mooted as a source of electrical energy; so far nothing has been done, but given cheap electric energy from these two sources the manufacture of nitrate of calcium in South Africa could readily be accomplished.

Government Guano.

It is notified that the second and final allotment of guano for this year will be made early in July next. It is expected that about 1500

tons of guano will be available for disposal in this allotment, but as the quantity which will be ready for delivery in July and August will in all probability not be sufficient to supply allottees during those months with the full quantities allotted to them, deliveries will be effected in instalments as shipments of guano arrive from the coast. All applications must be made on a prescribed form, which can be obtained from the Superintendent of the Government Guano Islands, Capetown, and these will be received and booked up to the end of June next, after which date no further applications can be entertained in respect to this season's crop. The distribution of guano will be limited to bona fide farmers and gardeners only within the Union, and preference will be given to applicants requiring supplies for use during the second half of this year. Applications may be sent in direct or through an agent or storekeeper, but in no case will the guano be supplied or consigned to any persons other than those for whose use it is required. The present price of guano is £5 per ton of 2000 lb. or 10s. per bag of 200 lb., including bags and delivered on rail at Capetown, or on board ship in the Table Bay Docks. Railage or freight in all instances is payable by the consignee and where guano is to be consigned to railway sidings this must be prepaid. All inquiries and applications for guano must be sent in direct to the Superintendent, Government Guano Islands, 69 Strand Street (G.P.O. Box 251), Capetown, but no remittances will be accepted until after allotments have been made. There will be no further allotments of guano after this until January, 1914, full particulars in regard to which will be notified in due course.

A Misleading Advertisement.

It has come to the notice of the Department of Agriculture that the Dreadnought Chemical and Tobacco Company is advertising in certain sections of the Press in such a way as to make it appear that the Government recommends the use of Dreadnought Tobacco Extract for dipping. Farmers and others should note that the extract from the Department's letter quoted in the advertisement does not contain a recommendation of any particular tobacco dip, but makes a general statement that a tobacco dip containing not less than 8 per cent. of nicotine is an efficient remedy for scab in sheep in the opinion of the Department. The letter, moreover, does not go so far even as to recommend an 8 per cent. nicotine dip; it merely expresses an opinion, which is of course entirely different from recommending a tobacco dip or a special brand of tobacco dip. The Company in question has, however, placed an unauthorized heading to the advertisement, giving the impression that the Government recommends the Dreadnought Tobacco Extract. If the Department desired to recommend proprietary dips it would in justice have to extend such recommendation to several.

Fat in "Cheese" Milk.

Cheese-makers generally are under the impression that small quantities of cream can be removed from "cheese" milk without in any way affecting the character of the manufactured product. An experiment was recently made at the Kilmarnock Dairy School to test this point, under the supervision of the director, Prof. Drummond. Six cheeses were turned out. These were manufactured from equal weights of milk (500 lb.) varying in quality from 0 per cent. up to

4.7 of fat. A photograph published in an exchange illustrates clearly the difference in size resulting from the varying elimination of fat from the milk. Between the no-fat cheese and the 4.7 per cent. one there was an actual difference in weight of 25 lb. This is more than sufficient to cover the extra value of the fat left in the milk. Experience has shown that milk that contains a low percentage of fat drains much more readily in the process of making than milk of average quality, and in the case of poor milk the normal percentage of water is not likely to be retained in the cheese. The result of this naturally is undue loss of weight, in addition to which the quality of the cheese is always more or less faulty by being tight and hard. The practical result of the experiment is that it does not pay to remove fat from milk that is to be made into cheese, and that to do so, be it little or much, reduces the weight quite appreciably, whilst the quality also suffers and a smaller weight of cheese of poor quality remains to be marketed at a reduced price.

A Good Poultry Record.

A correspondent sends to an American exchange an interesting statement showing his profits in poultry-keeping over ten years. He says: "My property was in a large city, and I could not protect myself from thieves, and the break-up of my family forced me to sell my home." This is his statement:—

Year.	Hens.	Total Eggs.	Eggs Sold.	Receipts: Eggs and Fowls.	Feed Lost	Profits.
1898 ...	240	25,238	23,475	$566.37	$179.63	$386.74
1899 ...	250	26,264	24,996	631.46	174.10	457.36
1900 ...	210	22,817	21,513	532.47	148.80	383.67
1901 ...	280	28,273	27,122	727.00	155.35	571.65
1902 ...	325	34,559	33,186	915.27	297.37	617.90
1903 ...	410	44,904	42,641	1125.58	392.73	732.85
1904 ...	440	48,223	46,609	1250.49	280.38	970.11
1905 ...	437	47,413	45,926	1266.13	440.33	825.80
1906 ...	438	45,855	45,268	1182.46	326.20	856.26
1907 ...	408	42,887	40,793	1070.88	379.44	691.44
	3438	366,433	351,529	$9268.11	$2774.33	$6493.78

"Over 2 per cent. of all eggs gathered were used in family," correspondent proceeds, "being cracked, badly stained, or defective in some way—unsaleable. Average number of eggs laid yearly per hen, 106. Average receipt from each hen beyond feed and care, $1.89 [7s. 10d.] per year. No eggs were sold at fancy prices; all sold for family use. Each year at least 800 eggs for hatching were used. Defective eggs and manure fully paid for all care and labour. Labour averaged less than two hours each day. During the whole ten years at least 10 per cent. of all eggs and hens were stolen. In 1900 a double lot of chickens were hatched, as over 250 hens were stolen." Can any South African reader furnish us with such a statement?

The Chinese Goose.

Poultrymen will be interested in the following letter and reply appearing in the *North British Agriculturist* of the 3rd April. The

case seems to be a unique instance of egg laying by a Chinese goose. A correspondent writes: "I have a Chinese goose which I bought last July. She is a young bird. I was told she laid on all spring. Since 1st April she has given me twelve dozen eggs, and still continues laying." In reply, the veterinary editor of our contemporary expresses the opinion that this case is a record, and quotes the following passage from Edward Brown's "Races of Domestic Poultry": "In an American report (Rhode Island Experiment Station, 1897) it is stated that the brown and white Chinas are early and prolific layers, and fair-sized eggs. If well fed they not infrequently lay in the autumn months, but generally those which do so lay later and fewer eggs the following spring. At the same station, in 1896 and 1897, the white Chinese laid in every month from January to June inclusive, while the brown Chinese did not begin laying until February, but continued laying freely into June. The highest records were fifty eggs from the white goose and forty-two eggs from the brown goose. The eggs are not so large as those obtained from Embden or Toulouse geese."

Nurserymen and Seedsmen's Association.

The annual meeting of this association was held on 27th and 28th March in the Grand National Hotel, Johannesburg, when each Province was represented by delegates. The chair was taken by Mr. H. E. V. Pickstone, Groot Drakenstein. The general business of the association having been dealt with, the meeting proceeded to discuss matters of general interest. It was felt that there were many points connected with the horticultural trade which could be more effectively dealt with in consultation with the officials of the Department of Agriculture, and it was decided to request the Department to recognize the association as an advisory body for the purpose of consultation with Government experts on technical and commercial points connected with the trade. In this respect the association is requesting the Government to introduce regulations which shall prevent the sale and distribution of weedy and worthless seeds which are so often a cause of great loss to purchasers, and intimated its readiness to assist in any way the drafting of such regulations as shall tend towards this desirable result. The meeting also expressed its approval of the action taken by the South African Agricultural Union requesting the Government to introduce seed purity laws. In regard to a proposal by the Department of Agriculture to prohibit the entry into South Africa of all fruit stocks from abroad, it was considered desirable that this association should confer with the various chiefs of the Agricultural Department before a decision could be arrived at. The trade anticipated a very great development during the next few years in fruit growing, and a greatly increased demand for young trees during the next few years. In regard to the work being done by the Division of Horticulture, the association decided to submit to the Department of Agriculture that the Division is much understaffed, and that a far greater expenditure should be authorized for the Division. The meeting was also of opinion that attention should be directed to the desirability for (*a*) the standardization of fruit varieties; (*b*) the accumulation and dissemination of knowledge connected with those varieties of fruits most suitable for the different

districts of South Africa. In order to check the dissemination of insect pests by irresponsible parties who evade the nursery regulations and consequent safeguards which are imposed on all registered nurserymen to prevent the spread of such pests, it was decided to recommend that the Department of Agriculture require that the grower's name be made known in connection with all plants sold by public auction, and that it be published on all sale announcements as well as at the time and place of sale. Mr. T. R. Sim, of Maritzburg, was duly elected Secretary for the Union Association for the coming year.

S.A.N.U. and Farm Pupils.

With regard to the scheme which the South African National Union has in hand for placing young fellows with farmers in this country, to which reference was made in our last issue, we are asked to say that the work is not to be limited to men from oversea. A number of applications have been received from youths already here, and every effort will be made to bring such youths in touch with farmers willing to take them. Broadly, the scheme has for its object a reduction of the present disparity of our white and coloured populations. If young fellows can be attracted from the towns to the land, much will have been gained, but that alone is insufficient. Our total white population must be increased, and so the two processes named can go on hand in hand. Moreover, when a man goes on to the land he becomes a producer, and it is the number of these that we must increase before we can export or even supply the local demand, which steadily increases as quality improves and is maintained.

"Analyses of Prize Wines."

With reference to the article on "Analyses of Prize Wines," by Mr. J. Muller, which appeared in the March issue of the *Journal*, we are asked to state that in the chemical data with respect to sample No. 43, 2nd prize, J. Sedgwick & Co., Class 23, the volatile acid in their sample of port was, through a clerical error, given as 1.11, whereas it should be 0.87 acetic acid per mille.

Some Recent Books.

FIRST PRINCIPLES OF FEEDING FARM ANIMALS. A Practical Treatise on the Feeding of Farm Animals: Discussing the Fundamental Principles and Reviewing the Best Practices of Feeding for Largest Returns. By Charles William Burkett, Editor, *American Agriculturist*; formerly Professor of Agriculture in the New Hampshire and North Carolina Colleges of Agriculture and Mechanic Arts, and Director of the Kansas Agricultural Experiment Station. (New York: Orange Judd Company. 1912.)

The fundamental principles of feeding animals are applicable to all parts of the world. For many years investigators have been at work on problems of nutrition and on interpreting the data obtained; and as a result the student has now at hand useful suggestions that will assist in handling the feeding problems of the farm to the best advantage. Mr. Burkett, who not only has been a teacher of animal nutrition for many years, but has had a lifetime experience also with the practical problems of feeding in the paddock and the stable, discusses the first principles of scientific feeding, interpreting them so

as to be equally useful to student, stockman, and farmer. Beginning with a study of the balance of Nature and of the contents and digestion of feeding stuffs, Mr. Burkett proceeds to discuss the using of feeds for obtaining the best results, the composition of animals, food nutrients, scientific terms in feeding, the computation of rations, the basing of standards on the quality of milk, the computation of rations on the basis of starch values, the use of energy values for computing rations, and the determination of the cost of the rations. We then come to studies on the feeding of breeding animals, farm horses, dairy cattle, beef cattle, sheep, pigs, and farm poultry; and the work concludes with three useful chapters on the silo and silage, the soiling system, and the relation of food to manure. The book is copiously illustrated; and Mr. Burkett writes in a business-like style, always to the point, and without unnecessary verbiage. He has provided a work that will not only prove useful to the student-farmer, but which also realizes the desire expressed by the author in his preface to keep in mind at every step the needs of the teacher of animal feeding.

THE YOUNG FARMER: Some Things he should Know. By Thomas F. Hunt. (New York: Orange Judd Company. 1912.)

The scope of this work is extensive, though the treatment is direct. Chapters are included on essentials of success, means of acquiring land, farm organization, opportunities in agriculture, selection of farms, the farm scheme, rotation of crops, equipment, how to estimate profits, grain and hay farming, the cost of farming operations, the place of intensive farming, returns from animals, farm labour, shipping, marketing, rural forces, and other matters of less interest to the South African. Whilst this is a work written more from the point of view of American conditions, there is much sound advice contained in its pages which would be well taken to heart by the young South African farmer.

ELEMENTARY LECTURES ON VETERINARY SCIENCE, for Agricultural Students, Farmers, and Stock-keepers. By Henry Thompson, M.R.C.V.S., Lecturer on Veterinary Science at the Aspatria Agricultural College. (London: Bailliere, Tindall & Cox. 10s. 6d.)

This is the fourth edition of Mr. Thompson's useful work. The third edition was issued in 1908, and was taken up so readily owing to its increasing popularity amongst agricultural students both in Great Britain and abroad, that a further edition became necessary. All the plates with which the book is profusely illustrated have been redrawn, and the text has been carefully revised throughout as well as in several places enlarged, whilst special reference has been made to the new mode of treatment and prevention of disease by vaccine and serum therapy, or the inoculation of animals with specially prepared vaccines and serums.

LESSONS ON SOIL. By E. J. Russell, D.Sc. (Lond.), Goldsmith Company's Soil Chemist, Rothamsted Experimental Station. (Cambridge: At the University Press, 1912; 1s. 9d. in South Africa.)

Dr. Russell's book is one of the well-known Cambridge Nature Study Series—in fact, was issued in 1911 as the first of the series, the copy before us being a reprint. The book is, of course, elementary, and for that reason will be found a valuable beginning to the study of the soil by young students, as well as by those farmers who, with

little or no real knowledge of the soil, nevertheless realize that more or less to understand this element is to lay up a store of knowledge that will assist them to no small extent in their agricultural operations. Dr. Russell tells us what the soil is made of and how it has been made, dwelling upon the constituent clay, and the action of lime upon this material, and proceeding to discuss the qualities and functions of sand. By means of experiments he shows how the mineral portion of soil may be separated from the organic; and then goes on to discuss the plant food in the soil, the dwellers in the soil, the soil and the plant, and cultivation and tillage. In each chapter experiments are described in order that the reader may study for himself the various phases of his subject at first-hand.

Miscellaneous Notes.

Out of 56,799,994 acres, the total area of Great Britain, only 9,000,000 are unused for agricultural purposes.

We have received a copy of the 1913 seed catalogue issued by Messrs. C. Starke & Co., Ltd., Mowbray, Cape Province. A very large variety of farm and garden plants is illustrated and described, and there is an interesting and well illustrated account of the firm's farm at Moorreesburg.

"Egg Production in South Africa: A New Method," is the title of a new pamphlet from the pen of Mr. M. Hanford (Capetown: Townshend, Taylor & Snashall; and at all railway bookstalls, 1s.). The author claims that by his system eggs can be obtained all the year round.

The world's Ayrshire dairy record is stated by the *Journal of Agriculture* (Montreal) to be held by "Daisy of Ferndale" (26735), owned by Mr. W. C. Tully, of Athelstan, Quebec. This cow qualified in the Canadian Record of Performance test with 15,533.9 lb. milk and 590.3 lb. butter-fat, equivalent to 688.7 lb. butter, given in 365 days.

We have received from the secretary, Messrs. Heynes, Mathew, Ltd., Capetown, a copy of a schedule which has been prepared for the registration of meteorological data by students at Government schools, at a large number of which the recording of simple weather observations has begun. The form is a simple one, and should prove fully satisfactory for its purpose.

An International Exposition, commencing on 20th February, 1915, and closing on 4th December, is to be held at San Francisco to celebrate the opening of the Panama Canal. Pedigree stock will be an outstanding feature of the exhibition. Full particulars may be obtained from the Information Bureau of the Panama Pacific International Exposition Company, San Francisco, California, United States of America.

The manager of the Government Dry-land Experimental Station, Lichtenburg, has now for disposal a quantity of seed potatoes ("Northern Star"), an excellent yielder, which has been successfully grown on dry lands for a period of four years, and has proved to be a very good variety for this system of culture. Owing to the

enormous demand for seed, it is essential that all orders, which must be accompanied by a remittance (the purchase price), should be placed as early as possible. Price 15s. per bag of 153 lb., free on rail at Lichtenburg Station.

A prospectus of the Graaff-Reinet Ostrich and Lucerne Farms, Ltd., has been issued in London. There is a nominal capital of £100,000, of which 50,000 £1 shares are offered for subscription at par. The company has been formed for the purpose of carrying on the businesses of the irrigation and cultivation of selected lands in the Graaff-Reinet District for ostrich, lucerne, and dairy farming. The registered offices of the Secretaries, the Anglo-African Bureau, Ltd., are at 5 Southampton Street, Strand, London, W.C.

Mr. A. S. Hudson, Hamans Kraal, Pretoria District, desires to obtain a copy of No. 1, Vol. I, of the English edition of the *Transvaal Agricultural Journal*, and asks us to say that he will be willing to exchange any or all of the following issues of the same journal for the number he requires:—In English: Vol. I, Nos. 3 and 4; Vol. IV, Nos. 15 and 16; Vol. VI, No. 22; Vol. VII, Nos. 26 and 27; Vol. VIII, Nos. 29 and 30. In Dutch: Vol. I, Nos. 1, 2, 3, 4, and 7.

The Pinetown (Natal) Horticultural Society held their annual general meeting in Durban on the 17th May. In their annual report the committee stated that good progress had been made. At the last show the total number of entries was 593, as compared with 408 in 1912, the vegetable section showing the largest increase. Sir Matthew Nathan, G.C.M.G., the Right Honourable General Botha, P.C., the Honourable C. J. Smythe, Senator F. O. F. Churchill, and Mr. W. Pearce, M.P.C., were elected patrons of the society, and Mr. H. T. Trotter president.

The Reuter cable published last month to the effect that the Union Government has appointed an expert to proceed to England to investigate the sheep-dipping question is hardly correct. What has happened is that Mr. C. Mallinson, the Principal Flockmaster, sailed for England in May on a hard-earned holiday, and that the department has taken advantage of his presence in the Old Country to ask him to make inquiries with a view to ascertaining public opinion in England on the dipping question. He has not been specially appointed to this duty, the matter being quite an informal one.

RAMIE CULTURE.—Persons contemplating the growing of ramie will doubtless be interested in the following conclusions presented by the committee on ramie at the Fibre Congress at Sourabaya, Java:—"It is not necessary to make further studies, because (1), as far as is known, ramie cultivation by Europeans has never been profitable; (2) by reason of statements made by experts at the congress that the elementary fibre of ramie lacks elasticity necessary for durable woven goods, and therefore may be used only for special purposes; (3) at present no machines are known for decorticating ramie fibre so as to satisfy economic conditions."

HAIL-DAMAGED BANANAS.—In advising the repair of the damage done by hailstorms in banana fields, the *Journal* of the Jamaica Agricultural Society suggests that old fields of bananas on large estates should be cut down knee high and fresh suckers planted in

between. For the smallholder who requires bananas for food and not for export it is best to leave the battered trees as they are, for even if they give rise only to small bunches of fruit these will be valuable for food, even though they are useless for export. Peas and beans (but not sweet potatoes and pumpkins) should be planted in between the rows.

A NOVEL TREE SPREADER.—A novel, yet simple, form of tree spreader for orchard work is described by a writer in the *Rural New Yorker*. A great number of his young apple trees were difficult to get into shape, and very often two branches which he could not afford to lose would grow up straight side by side or twist around. To overcome this he used spreaders made of maize stalks about a quarter or three-eighths of an inch thick. These he cut wedge-shaped at each end. The pith in the centre of the stalk forms a cushion the shape of the branch, prevents bruising, and presses tightly so as not to be shaken out by storms.

AGRICULTURAL CONDITIONS AT RUSTENBURG.—Reporting on agricultural conditions in Rustenburg at the end of March, Mr. H. W. Taylor, the Officer in Charge of the Experiment Station, observed that the rains of the past two months had greatly improved conditions in general. The streams were now flowing as usual, and this would enable farmers to sow their winter crops of forage and wheat. The veld grasses were showing considerable growth, so that winter grazing promised to be better than was anticipated earlier in the season. "The late tobacco is coming on nicely," Mr. Taylor reported, "and shows great improvement. There is, however, a considerable acreage of very large tobacco which will be caught by the frost should the winter come on at the usual time. The late mealies throughout the district are also showing marked improvement, but the crop will be very light."

CAPE JUDGES' EXAMINATIONS.—The following are the results of the qualifying examinations held at Middelburg (Cape) by the Cape Province Agricultural Judges' Association on the 6th and 7th May:—*Thoroughbred Section*: Examiners, Messrs. F. S. Schimper and Alex. Robertson. Out of eight candidates the following were successful: T. B. Clapham, C. Meintjes, and S. W. Vorster, jun. *Merino Sheep Section*: Examiners, Messrs. J. H. King, D. Hockley, and W. E. Edwards. Out of fifteen candidates the following were successful: E. H. Berrington, A. E. Romyn, and G. Bekker. *Shorthorn Cattle Section*: Examiners, Messrs. C. A. Pope, E. G. King, and J. Dewar. The following out of fourteen candidates were successful: F. W. Johnson, A. E. Romyn, W. A. J. Love, and R. J. Hodges. *Friesland Cattle Section*: Examiners, Messrs. L. Harrison, F. F. Wienand, and A. A. Kingwell. Out of sixteen candidates the following were successful: G. Bekker, A. E. Romyn, F. W. Johnson, and L. Cloete.

A NOTABLE SHORTHORN SALE.—In our April issue we referred to the great sale of Shires at Lord Rothschild's stud-farm at Tring Park. Another important sale has lately been held at the same place, namely of Shorthorns. The excellence of the herd attracted a large attendance, and a good trade was done. The best price of the day was realized by the dark roan bull calf Drusus, one of the Darlington Cranfords, calved in August, 1912, which fetched 260 guineas.

Among the cows, the highest bids were brought by Darkey and Fragrance, namely, 200 guineas. Several lots were purchased on behalf of the Union Government, including the dark roan cow Mystery, calved July, 1910 (51 guineas); the red cow Dream, calved February, 1911 (45 guineas); Dimple, a red and white cow, calved February, 1911 (65 guineas); Handsome 18th (red and white), calved April, 1911 (50 guineas); and Bluebell (red and white), calved April, 1911 (51 guineas). The total amount realized at the sale for fifty-seven cows and heifers and ten bulls was £6144. 12s., the averages being £89. 0s. 2d. for cows and heifers and £91. 14s. 3d. for bulls.

Government Stallions for Lease.

PARTICULARS REGARDING 1913-14 SEASON.

1. Applications to hire stallions for next season should be made on or before 12th July, 1913, to the Secretary for Agriculture.

2. The service season will extend from 1st September, 1913, until 1st March, 1914, on or before which date all stallions must be returned to the farm from which they are leased. Delivery may be taken between 1st September and 1st November.

3. Stallions will be leased only to bona fide farmers (i.e. those who gain the greater part of their livelihood from farming), either individually or collectively, to farmers' associations, and to agricultural societies, as approved by the Minister of Agriculture.

4. As the number of stallions is limited, preference will be given to owners of mares in the best horse-breeding districts. In allotting the stallions, consideration will also be given to the facilities which exist in certain districts for the service of mares by stallions owned privately. In order to facilitate the allotment of the stallions it is requested that each applicant should apply for more than one stallion, preferably three should be chosen, and the applicant should state the priority in which he desires his choice to be considered.

5. The lessee or lessees will be permitted to have twenty-five of his or their mares served by the stallion which he or they have leased. They must also undertake to make all necessary and suitable arrangements for the services of a similar number of mares from other owners. No such owner will be permitted to have more than five mares served under this arrangement, except upon written authority being received from the Secretary for Agriculture or his deputy. Not more than fifty mares may be served by a stallion without written permission of the Secretary for Agriculture or his deputy. The fees to be charged for such services will be as stated hereunder, and will be payable direct to the lessee or lessees.

6. The service fees as stated above shall be 5 per cent. of the leasing fee, e.g. if the charge for leasing a stallion be £40, the service fee for each mare shall be 40s.

7. The lessee or lessees shall bear the cost of feeding, attendance, and care of the stallion and his equipment, and they must conform to the requirements of the Department of Agriculture in these respects. Applications will only be favourably considered from those who can provide suitable accommodation in the form of a loose-box, from which the stallion can be taken "out and in" without passing other horses. The following particulars of the loose-box *must be submitted with the application*:—(1) Height to eaves; (2) length; (3) width; (4) kind of floor; (5) character of building, i.e. whether of brick, iron and wood lined, etc.

8. The Department of Agriculture will not be responsible for any loss which the lessee or lessees may sustain in the event of delivery of the stallion not being effected through death, accident, or any other cause, but in such instance the leasing fee will be remitted. If during the service season the stallion becomes incapacitated from any cause whatsoever, the Department of Agriculture will likewise not be responsible for any loss, and in such instance no part of the leasing fee will be remitted. All stallions leased are believed to be "foal getters," but no guarantee in this respect is given.

In the event of a stallion dying during the period for which he has been leased, or becoming damaged through any action or neglect, the lessee or lessees shall be liable for damages to the extent of the leasing fee.

9. Stallions will not be allowed to run with mares, but must be kept in hand, and all mares must be haltered for service.

10. Stallions will be delivered by the Department of Agriculture at the nearest railway station to the place where they are to stand at stud. At the termination of the season the stallion will be taken over by the

Department of Agriculture or its representative. All rail charges will be borne by the Department of Agriculture.

11. Due care must be taken that stallions shall not serve mares suffering from any contagious disease.

12. The Department of Agriculture shall, through its representative, have the right at any time to inspect the stallions leased.

13. Payment for hire of stallions must be made within fifteen days after the successful applicant or applicants have been advised of the allotment of a stallion.

14. Lessees are requested to furnish particulars of all mares served. For this purpose suitable cards, which should be returned at the end of the season to the officer in charge of the farm from which the stallion has been leased, will be supplied by the Department of Agriculture.

15. In submitting their applications, applicants will be deemed to have undertaken to comply with all the conditions mentioned herein. Should any of the conditions not be complied with, the Department of Agriculture shall have the right to remove the stallion at once, and the lessee or lessees shall in such case forfeit the money paid for hire.

Particulars of the stallions to be leased and fees charged are stated hereunder.

STUD FARM, STANDERTON.

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Sir Reginald....	£60	60s.	Thoroughbred; foaled 1896; dark brown; by Hagioscope out of Empress Maud by Beauclerc; height, 16 hands; bone, 8¾ in. A very powerful short-backed horse, suitable for breeding ride and drive horses.
Jannaway......	£60	60s.	Thoroughbred; foaled 1902; chestnut; by Jeddah out of Sandiway by Doncaster; height, 16 hands; bone, 8 in., of fine quality; should be mated with fairly heavy mares to give good useful ride and drive horses.
Mon Roy......	£60	60s.	Thoroughbred; chestnut; foaled 1902; by Orme out of Mon Droit by Isonomy; height, 15·3 hands; bone, 8 in. A very compact horse; should be mated with heavy mares.

STUD FARM, STANDERTON (*continued*).

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
The Phoenician	£60	60s.	Thoroughbred; bay; foaled 1907; by Crebe out of The Israelite by Isosceles. A very powerful short-backed horse of the hunter type, with 8½ in. bone, and should breed good ride and drive horses. Height, 15·3 hands.
Greenwood.....	£55	55s.	Thoroughbred; bay; foaled 1907; by Greenan out of Salvia; height, 15·2½ hands, with 8¼ in. bone. A powerful, compact, truly made horse.
Cairn Ryan....	£50	50s.	Thoroughbred; bay; foaled 1899; by Enthusiast out of Finnart by Ayrshire; height, 16·1 hands; bone, 8½ in. A very powerful short-backed horse, suitable for breeding ride and drive horses.
Proxy.........	£45	45s.	Thoroughbred; bay; foaled 1902; by Earl Douglas out of Dentelle by White Feather; height, 15·1½ hands; bone, 8½ in. A very powerful, compact horse, suitable for breeding ride and drive horses.
Florismart.....	£40	40s.	Thoroughbred; dark brown; foaled 1895; by Martagon out of Floranthe by Muncaster. A short-legged horse: height, 15·2¾ hands, with 8½ in. bone. This horse combines quality with substance. (Limited to thirty mares.)
D'Arcy........	£40	40s.	Thoroughbred; foaled 1896; by Ayrshire out of Cosy by Sealskin; bay; height, 16 hands, with 8½ in. bone. Slightly on leg and light of barrel. (Limited to thirty mares.)
Kennythorpe...	£40	40s.	Thoroughbred; foaled 1899; brown; by Calthorpe out of Kenny by Mardon; height, 15·3 hands; bone, 8 in. Suitable for breeding carriage horses.
Candil *........	£35	35s.	Thoroughbred type; chestnut; foaled 1897; by Sargento out of Vhalia by Whipper In; height, 15·2 hands; bone, 8½ in. A horse of fine quality. Should be mated with heavy mares.

* Ineligible for registration in Stud-book.

STUD FARM, STANDERTON (*continued*).

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Little Dick *...	£30	30s.	Thoroughbred type; bay; foaled 1893; by Dick Swiveller out of Magenta; height, 14·3½ hands; bone, 8 in. A very nice horse, suitable for breeding mounted infantry cobs.
Bridgham Charlie	£50	50s.	Hackney; by Orangeman out of Bridgham Pansy by Hidon Comedian; height, 15·2 hands; bone, 7¾ in. A sharp, active horse with nice action. Suitable for breeding good carriage horses.
Radium *......	£45	45s.	Hackney; black; by Vitality out of Ruby by M.P.; height, 15 hands; bone 8½ in. A thick, powerful horse without extravagant action, suitable for breeding carriage horses.
Jargeau........	£40	40s.	Percheron; black; foaled 1909; by Gaulus out of Saidante. A powerful horse, suitable for grading up and producing heavy draught horses.

SCHOOL OF AGRICULTURE AND EXPERIMENT STATION, POTCHEFSTROOM, TRANSVAAL PROVINCE.

Bedminster	£40	40s.	Thoroughbred; chestnut; foaled 1905; by St. Maclou by St. Simon; dam, Early to Bed by Wisdom; 16 hands high, with 8 in. bone; girth, 6 ft. 1 in. Should be mated with strong mares to secure riding or carriage horses.
Lord of Tottenhill	£40	40s.	Hackney; bay; foaled 1906; by Lord Donoghue (No. 3743); dam, Nin (No. 20901) by Prestige; 15·3 hands in height; 8½ in. bone; girth, 6 ft. 5½ in. A powerful horse, suitable for mating with light mares to get carriage horses.
Krampon......	£40	40s.	Percheron; dark grey; foaled 1910; by Grillon; dam, Theresa. An active draught horse; may be used to breed horses for farm or dray work.

* Ineligible for registration in Stud-book.

STUD FARM, TWEESPRUIT, ORANGE FREE STATE.

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Wilkins Micawber	£75	75s.	Thoroughbred; bay; foaled 1905; by Simontault out of To-morrow by Satiety. Possesses excellent bone, great girth, good loin and quarters, and is well balanced. Champion horse at 1913 Witwatersrand Agricultural Show.
Hearwood......	£50	50s.	Thoroughbred; bay; foaled 1896; by Glenwood out of Hear-hear by Applause. A handsome animal of great style and character. Would produce good saddle or harness horses and is specially recommended for compact mares. (The Department of Agriculture reserves to itself the right of nominating up to ten mares to this stallion, for which no fees are to be charged.)
Silver Wedding.	£60	60s.	Thoroughbred: chestnut; foaled 1902; by Cherry Ripe out of Miss Georgie by Baron Farney. Perhaps one of the most suitable all-round horses in the stud for general utility purposes. Has left some excellent hunter stock.
Valiant........	£60	60s.	Thoroughbred; foaled 1899; brown; by Ladas out of Surprise-me-not by Enterprise. Possesses good quality and true action. Should breed good carriage horses if mated to heavy mares. Champion stallion at 1913 Central Agricultural Show, Bloemfontein.
Quelpart.......	£60	60s.	Thoroughbred; foaled 1905; bay; by Grey Leg out of Guava by Galopin; stands 15·2 hands. Most suitable for breeding mounted infantry cobs.
Ninian.........	£60	60s.	Thoroughbred; chestnut; foaled 1907; by Ninus out of Limonite by Clairvaux. A good all-round horse for breeding riding and drive horses, and should be especially suitable for small mares.
Blue Streak....	£50	50s.	Thoroughbred; bay; foaled 1899; by Blairfinde out of Babette by Ben Battle. On short legs with enormous bone. Will suit almost any class of mare to breed good riding horses.

STUD FARM, TWEESPRUIT (*continued*).

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Sang Bleu	£50	50s.	Thoroughbred; bay; foaled 1898; by Royal Hampton out of Merry Duchess by Speculum. Stylish horse and should produce good cart and riding horses. Will suit most kind of mares.
Dominie II.	£50	50s.	Thoroughbred; bay; foaled 1896; by Sensation out of Dolores by Mortemer. Should breed good carriage horses, having extraordinary action for a thoroughbred.
The Negus	£50	50s.	Thoroughbred; brown; foaled 1905; by Matchmaker out of Jebba by Jannissary. Should have good quality mares, being a bit coarse in head. A good, straight mover.
Alcedo	£50	50s.	Thoroughbred; bay; foaled 1904; by Matchmaker out of Castlehampton by Hampton. A good all-round horse for breeding ride or drive horses. Should be mated to short-legged mares.
Laughing Gull	£50	50s.	Thoroughbred; chestnut; foaled 1902; by Gallinule out of La Joie by Ayrshire. Perhaps one of the best topped horses in the stud and has left some very good stock.
Hermiston	£50	50s.	Thoroughbred; bay; foaled 1895; by Rightaway, dam by Galopin. Full of quality and has proved himself a good sire of riding and carriage horses.
Grand Slam	£40	40s.	Thoroughbred; brown; foaled 1899; by Trenton out of Thalma by Penegrieve. Should be mated to compact mares with bone and quality.
Shortboat	£40	40s.	Thoroughbred; chestnut; foaled 1908; by Bacton Lad out of Arianwen by Vesuvius. Has plenty of bone, but rather deficient in quality; he should, therefore, be mated to good quality mares. A good topped-horse, but a bit coachy, and is likely to breed cart horses rather than riding horses.
Barkston Ash	£40	40s.	Thoroughbred; chestnut; foaled 1904; by Pride out of Impi by Chittabob. Should be mated to strong, good-topped mares.

STUD FARM, TWEESPRUIT (*continued*).

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Rappe.........	£50	50s.	Oldenburg; dark brown; foaled 1906. Very compact horse, possessing true action. Useful for grading up and for producing foundation stock.
Fokus.........	£40	40s.	Oldenburg; brown; foaled 1907. Good top and bone. Useful for grading up and producing foundation stock.

STUD FARM, ROODEPOORT.

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Sentinel........	£40	40s.	Thoroughbred; chestnut; foaled 1905; by Picquet out of America by Amianto. Standing about 15 hands 2 inches, with plenty of bone. Useful sire, especially for breeding harness horses.
Red Lord......	£35	35s.	Hunter-bred type; foaled 1907; bay; by Red Prince II. out of Lady Lawrence H.B. Rich bay with black points, standing 16 hands 1 inch. Bred in Ireland. Possesses good bone and substance.
St. Patrick.....	£40	40s.	Hunter-bred type; foaled 1902; bay; by Home Rule out of Heart of Oak by King of the Forest. Standing about 16 hands 3 inches. Possesses good bone and substance.
Wildschutz..... (No. 2182)	£40	40s.	Oldenburg; foaled 1908; brown; by Martinius (No. 1555) out of Wildspitze (No. 12294) by Wittelsbacher (No. 1525); height, 15 hands 3 inches; with heavy bone and substance. Useful for breeding heavy horses.
King Sos......	£40	40s.	Percheron; grey; foaled 1909. Suitable for breeding heavy draught horses.

SCHOOL OF AGRICULTURE AND EXPERIMENT STATION, GROOTFONTEIN, MIDDELBURG, CAPE PROVINCE.

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Boss Up.......	£50	50s.	Thoroughbred; chestnut; foaled 1905; by Beware out of Lilly Bridge by Keedom. Standing 15·3 hands high, with $8\frac{1}{2}$ in. of bone. Good type for breeding riding as well as general purpose horses.

Experiment Station, Grootfontein (*continued*).

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Merrimac......	£50	50s.	Thoroughbred; brown; foaled 1905; by Mackintosh out of Mereden by Hampton. Standing 15·2 hands high, with plenty of bone. Compact horse on short legs. Suitable for breeding general purpose horses.
Patron Saint....	£60	60s.	Thoroughbred; chestnut; foaled 1898; by St. Frusquin out of St. Helen by Springfield. Standing 15·3 hands high. Of very good quality and a good breeder.
Iron Pirate.....	£50	50s.	Thoroughbred; bay; foaled 1906; by Sir Geoffrey out of Spoil by Forager.
Examiner......	£60	60s.	Thoroughbred; bay; foaled 1903; by Donovan out of Inquisitive by Hampton. Compact horse on short legs. Should produce general utility horses.
Heacham Watchman	£50	50s.	Hackney; bay; foaled 1910; by Heacham Ripper (No. 8887) out of Heacham Lilian (No. 16672) by Noble Shot (No. 2200). Suitable for breeding carriage horses. Should be mated to short-legged mares.
Brookland......	£40	40s.	Hackney; chestnut; foaled 1906; by Vigour (No. 4055) out of Lady Kate (No. 5583) by Norfolk Comet (No. 491). A short-legged, compact horse; suitable for breeding carriage horses.
Baldur.........	£40	40s.	Oldenburg; dark brown; foaled 1910; by Engelhard (No. 1711) out of Blondlockig (No. 12149) by Asmar (No. 1171). Suitable for grading up and producing foundation stock.

School of Agriculture and Experiment Station, Elsenburg, Mulders Vlei, Cape Province.

Whyte Melville.	£60	60s.	Thoroughbred; chestnut; foaled 1905; sire, Flying Fox; dam, Woodbury; dam's sire, Crowberry; height, 15·2½; bone, 8½ in. A compact horse of good quality. With weighty mares should breed high-class riding horses.

EXPERIMENT STATION, ELSENBURG (*continued*).

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Cyllaros........	£40	40s.	Thoroughbred; chestnut; foaled 1903; by Cyllene out of Silverling by Esterling. Standing about 15·3 hands high. Useful sire for breeding general purpose horses.
Peeping Light..	£35	35s.	Thoroughbred; brown; foaled 1900; by Vesuvian out of Peeping Rose by Hagioscope. Standing about 15·3 hands high, with plenty of bone. Useful general purpose sire.
True Metal.....	£35	35s.	Thoroughbred; chestnut; foaled 1907; by Gold out of Mare By by Hollander. Standing about 15·2 hands high on very short limbs, with $8\frac{1}{2}$ in. of bone below the knee. Useful for breeding general purpose horse.
Gipsy Boy.....	£45	45s.	Thoroughbred; bay; foaled 1908; by Paymaster out of Hesitation by Masterman or Old Buck; height, 15·2 hands. Heavy boned horse; suitable for breeding remounts.
Rillington Swell	£50	50s.	Hackney; dark chestnut; foaled 1910; sire, Brigham Gallant; dam, Cundalls Flirt; dam's sire, Croome Connaught; height, 15·$1\frac{1}{2}$ hands; bone, 8 in. Suitable for breeding good carriage horses.
Bury Cicero....	£50	50s.	Hackney; chestnut; foaled 1906; sire, Rosador; dam, Bury Duchess; dam's sire, Goldfinger VI.; height, 16·$\frac{1}{2}$ hands; bone, 9 in. Suitable for mating to light mares for breeding carriage horses.
Athlete........	£30	30s.	Clydesdale; black; foaled 1908; sire, Fortune Teller; dam, Banks Twilight; dam's sire, McGregor's Masterpiece; height, 16·$2\frac{1}{2}$; bone, 10 in. Suitable for breeding heavy draught horses.
Jasmin........	£40	40s.	Percheron; grey; foaled 1909. Suitable for breeding heavy draught horses.
Jack (1).......	£45	45s.	Catalonian bred; black; height, 14·2 hands; bone, 8 in. (Must only be allowed to serve horse mares.)
Jack (2).......	£45	45s.	Catalonian bred; black; height, 15 hands. Heavy boned. (Must only be allowed to serve horse mares.)

SCHOOL OF AGRICULTURE AND EXPERIMENT STATION, CEDARA, NATAL.

Name of Stallion.	Fee for Lease.	Maximum Fee to be charged by Lessee for each Mare.	Remarks.
Tiripapa	£50	50s.	Thoroughbred; bay; foaled 1904; by Collar out of Tiraillerie by Nordenfeldt. Full of quality; 8¼ in. bone. Should be mated with heavy mares.
Sir Charles	£50	50s.	Thoroughbred; chestnut; foaled 1900; by Kendal out of Green Rose by Springfield. Has sired some excellent foals. Good all-round horse for breeding up riding and driving horses.
Perrier	£35	35s.	Thoroughbred; bay; foaled 1905; by Perigord out of Grace Trenton by Trenton. Rich bay, standing about 15 hands 3 inches in height on good short limbs and plenty of bone. General purpose sire.
Sloanston	£45	45s.	Thoroughbred; brown; foaled 1907; by St. Serf out of Verdina by Prism. Standing nearly 16 hands high on good, strong, clean limbs, with 8½ in. of bone below the knee. Strong, useful sire.
Ballyhooley	£40	40s.	Thoroughbred; chestnut; foaled 1905; by Uniform out of Miss Sheilagh by Melton. Standing 15·3 hands high on good, clean limbs, with good head and neck. Suitable for breeding good carriage horses.
De Mist	£35	35s.	Thoroughbred; brown; born 1906, by Stormbound out of Dutch Daisy by Dutch Skate. Standing 15·2 hands high. Useful for breeding general utility horses.
King of All	£40	40s.	Clydesdale; dark brown; foaled 1909 by May King (No. 13098) out of Queen Mab (No. 24190) by Hillhead Chief (No. 17774). Suitable for producing heavy draught horses.

These horses may be inspected at the Schools of Agricutlure and Stud Farms by appointment with the officers named below, who wil a so supply any further particulars required.

Stallions at Standerton—

Manager, Stud Farm, Standerton.

Stallions at Potchefstroom—
Principal, School of Agriculture, Potchefstroom.

Stallions at Tweespruit and Roodepoort—
Manager, Stud Farm, Tweespruit, O.F.S.

Stallions at Cedara—
Principal, School of Agriculture, Cedara.

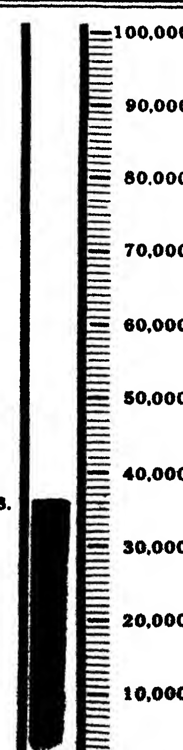
Stallions at Grootfontein—
Principal, School of Agriculture, Middelburg, Cape.

Stallions at Elsenburg—
Principal, Elsenburg School of Agriculture, Mulders Vlei, Cape.

All applications for hire should be addressed to the Secretary for Agriculture, Pretoria.

ALEX. HOLM,
Under-Secretary for Agriculture.

Department of Agriculture,
Pretoria, 11th June, 1913.



Correspondence.

This section will be set aside for correspondence on all subjects affecting the Farming Industries of the Union of South Africa and cognate matters; and, while every reasonable latitude will be allowed, contributors are requested to be as concise and succinct as possible in the expression of their views.

Suggestions for practical consideration and discussion, and hints as to improved methods applicable to any branch of agriculture will be particularly welcome.

It must at all times be distinctly understood that the Department of Agriculture is in no sense responsible for the views and opinions expressed in this section.

All communications should be clearly addressed "The Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria," and written on one side of the paper only.

LAMZIEKTE.

To the Editor of the *Agricultural Journal*.

SIR,—I am pleased to see a letter from Mr. E. W. Howarth in the *Agricultural Journal* for April *re* his experience of the use of bonemeal for cattle. If more farmers were to publish the result of the use of same I do not think we should hear of so many cases of "heavy losses through lamziekte," etc. I have repeatedly written and advocated the more general use of same, and I, like Mr. Howarth, have been told that my farm is not a lamziekte area. But, notwithstanding that on my previous farm that I sold I farmed for four or five years without lamziekte, the present owner has lost 70 or more per cent. through that and other diseases. I never lost over 5 per cent., taking the four years into account. The heaviest year's loss was when my whole farm was burnt out, when my losses were doubled on the previous and subsequent years.

I have over the past few years repeatedly written advocating the more general use of bonemeal. I may point out that I am now quite certain that by using bonemeal one gets a far better percentage of calves. I leave the reason of this to be shown by more capable men than myself. Perhaps some Government veterinary surgeon, or private one, would write a short article on same. Also, it must not be forgotten that the droppings of cattle which get a free use of bonemeal must be of far more benefit to the veld than from cattle that are not supplied with same. I may mention that I know of cases where bonemeal was of no avail, but when blood smears were taken the cause of death was "tick-transmitted gall-sickness," which, of course, bonemeal would not prevent. But one can now inoculate against same or dip and do away with the cause.

I am afraid, Mr. Editor, that I have taken up more room in your very valuable paper than I ought to, but if my letter is only the means of getting a few more farmers to use bonemeal I am sure it will not be of no avail. Dr. Robertson, of the Government Veterinary Research Department, is, he informs me, trying further experiments in the use of bonemeal, and I trust he will soon be able to publish the results; and I hope he will be able to show what better (if any) percentage of calves is got by using bonemeal, also what effect it would have (if any) on the veld.

After my last letter I had numerous letters asking me where to obtain bonemeal and how to use it. To these inquiries I would refer them to the Principal Veterinary Surgeon and your advertisements.—Yours, etc.,

A. B. BURNETT.

Hampton, P.O. Makanno Kop,
Western Transvaal.

To the Editor of the *Agricultural Journal*.

SIR,—I shall esteem it a great favour if you will recommend, in the opinion of your Department, the best known cattle-lick as a preventive against the above disease, which in latter years has become a serious matter to cattle

farmers in this district. A change of veld or pasture or good brak veld has been found of value, but good brak veld is procurable only by a few farmers, and we shall have to revert to artificial means to fight the disease.

Thanking you in anticipation,—Yours, etc.,

D. MACP. BECKETT.

Oxford, P.O. Mier,
Gordonia, Cape Province.

[The Acting Director of Veterinary Research (Dr. Wm. Robertson) replies:—I should advise the following: One part of bonemeal; one part of slaked lime; and two parts of coarse salt. This must be given in a trough with a shelter or lid, otherwise the rain will wash the salt out of the mixture. Perhaps Mr. Beckett would like to use Mr. Meintjes' lick, mentioned in the *Journal* some time back.]

To the Editor of the *Agricultural Journal*.

SIR,—I see a lot of correspondence in the *Agricultural Journal re* lamziekte and different opinions expressed. My experience is that lamziekte is caused only through keeping cattle and sheep continuously on the same veld. If it is brak veld it does not matter so much. I have seen sheep die, four and five out of a lot on one day of lamziekte, and after they had been brought on brak veld not one died. I have also seen donkeys die of lamziekte. This is caused, as far as I have found out, through the donkeys eating of the remains of dead animals which died of lamziekte. Very few come through.—Yours, etc.,

W. A. KOTZE.

Georgia, Nieuwhoudtville.

HORSE-SICKNESS.

To the Editor of the *Agricultural Journal*.

SIR,—The theory is that horse-sickness is caused by a mosquito or some other night-flying insect. I have an idea that it is caused by a fly which goes about in the day time, and I base my argument on the following observation, which is only a premise and goes no further:—

A day or so ago I was out with my Boer coachman, and when he was inspanning the horses at about 5 o'clock in the afternoon I noticed that the horses were very restless and could hardly be put into the harness on this account. I asked him what was the matter with the animals, and he informed me that they were being bitten by a fly and that they were always so restless when these flies were about. I then took note of the fly and found him to be of a species very similar to the ordinary house fly, but had a white spot on both sides of his body. In fact, to the common observer, one would have thought he was the common house fly. Only on close inspection does one notice the difference.

In person I have frequently noticed that there is a species of house fly (the same one to which I am now referring) which bites even human beings so severely as to draw blood. I have noticed them sting or suck me right through my socks when I have been lying quiet or travelling by cart. The bite is very similar to that caused by the fly with the big green eyes which we call the "blind fly," but it does not produce a swelling, only hurting very sharply at the time of the bite and drawing blood.

That is the premise, and if you think fit it could be investigated by the Agricultural Department to find out whether the bite of my spotted house fly causes horse-sickness in the same way as the tsetse fly causes that other disease in Rhodesia.

You may probably know the fly I mean, but in order to make my contention clear I shall try and catch one or two of them and send them up to you. They are a bit scarce to find when one particularly wants one.—Yours, etc.,

REG. C. READ.

Maquassi, Transvaal.

[Curiously enough, the theory propounded above is and has been experimented with at the Veterinary Research Laboratory in Pretoria. Dr. Robertson has several fly-proof boxes in which he is trying to communicate horse-sickness from the sick to the healthy animal through the agency of several of the biting flies.—Acting Editor, *Agricultural Journal*.]

ANTHRAX INFECTION.

To the Editor of the *Agricultural Journal.*

SIR,—Would an official in the Veterinary Division kindly answer the following:—

Can a tick that has dropped off, or been scratched off, an anthrax or sponsziek beast infect another animal? Naturally, if it dropped off it would not look for another host at once, but sometimes ticks can be scraped off by a beast going through bush, or even by handling. They may be rubbed off. Would any discharge, other than blood, infect the veld?—Yours, etc.,

A. G. DANIELL.

Sidbury, Highlands, Cape Province.

[The Acting Director of Veterinary Research (Dr. Wm. Robertson) replies:—It is possible for a tick to directly convey anthrax or black-quarter from one beast to another, but I should think it is extremely improbable that such ever occurred in nature. If you prick a beast infected with either of the two diseases with a needle, and by that means introduce some of the affected blood into the system of a healthy beast, the latter will most likely contract the disease. Nearly all the discharges and fluids in the animal's body in the case of anthrax contain blood, and therefore may be regarded as potential sources of infection. It is in this disease that you get blood in the dung, blood in the nasal discharge, and sometimes blood actually oozing through the unbroken skin. In regard to black-quarter, I carried out rather an interesting experiment. I had some riems made from the skin of a beast which succumbed to that disease. They were brayed and dressed in the usual way, and six months afterwards I produced black-quarter in a clean animal by putting the riem around his horns and causing an abrasion of the skin; and we know that these germs can remain in the soil or in dry blood perfectly virulent for years.]

ARTIFICIAL COMMUNICATION OF EAST COAST FEVER.

To the Editor of the *Agricultural Journal.*

SIR,—From various experiments it has been conclusively proved that East Coast fever can be communicated only by the tick, and that one tick is sufficient. Have any experiments been made to introduce the disease artificially by taking an infected tick or ticks, obtaining an *extract* from them, either by crushing them or soaking them in some liquid, and then, after mixing this "extract" with glycerine, to inject it into a beast?

It could, surely, be ascertained by experiment what quantity of "extract" was enough to give a beast the disease in a mild form, sufficient, however, to immunize it, and at the same time to standardize this "extract."

This is a layman's suggestion which the vets. may laugh at, but I have seen no account of its ever having been tried, and it might be worth an experiment. What does the Agricultural Department say?—Yours, etc.,

DUMA GUDE.

Mount Frere, East Griqualand.

[The above letter was referred to the Acting Director of Veterinary Research (Dr. Wm. Robertson), who observes:—The experiment suggested by your correspondent has been often tried and always with negative results. It would appear from this that the parasite of East Coast fever undergoes part of the developmental stage of its life history in the body of the tick, which in this case is not the simple carrier of the disease as in the case of biliary fever in the horse or redwater in cattle.]

CAUSTIC SODA AND SULPHUR DIP.

To the Editor of the *Agricultural Journal.*

SIR,—It was with great pleasure that I read in your issue of March, 1913, under the heading "Scab in Sheep and Goats," that your Chief of the Sheep Division recommended the use of either lime or caustic soda combined with sulphur as the best scab eradicator. I have used lime and sulphur in the past

with great success, and attribute the use of this dip as the only means by which I got clear of scab. A year ago I moved to this part of the country where such a thing as wood is an unknown quantity, and a month ago my sheep broke out with scab. It was the first time the sheep had had scab for four years. I dipped them, very much against my better judgment, with ———'s dip twice. I have, of course, checked the scab, I am sure, but I feel confident that it will not be long before they will begin to spot again. Now I want to use caustic soda and sulphur should this happen, but before doing so I would be much obliged if you would enlighten me on a few points:—

(1) I have some half tubs. Can I mix it in these tubs, or will it burn the wood of the tub?

(2) The tubs hold, I should say, about 30 gallons of water each. Can I not mix more dip than for 100 gallons of water in one of these tubs? Do you not think I could mix dip for, say, 200 gallons of water in these tubs?

(3) Must the amount of mixed dip in the tub be calculated extra? What I mean is, must I put 100 gallons of water in the tank and then put the mixed dip for 100 gallons in addition to this, making, say, 130 gallons of mixed dip?

(4) How long will the dip keep when once mixed in the tub? Must it be used at once? Why I ask this question is because I like to get my dip ready the previous day and start on my sheep at daybreak. My tank holds 550 gallons, and so the preparation of dip for this will take some time.

(5) If I stop dipping at, say, midday, in order to give all dipped sheep a chance to dry, and intend going on again the following morning, will it be quite all right adding new dip again to that that remained in the tank the previous day?

(6) How long will the dip remaining in the tank keep, should the following day be such that I cannot go on; I mean, if there should be rain or if it should be too cold?

(7) I propose getting a small iron tank—I mean one of those square riveted ones—and pour all the mixture for 550 gallons into this the day before and then mix another two lots in the two tubs enough for 400 gallons, so that no time should be wasted when once I start dipping. Do you think this a good plan? Or will the mixture corrode the tank to such an extent that it would soon be useless?—Yours, etc.

A READER.

[The Chief of the Sheep Division (Mr. B. Enslin) replies:—(1) Caustic soda could be mixed in the wooden tubs without material damage thereto. (2) It is better to mix the material for 100 gallons at a time. Twenty pounds of sulphur should be mixed with enough water to form a thin cream, then sprinkle 5 lb. caustic soda slowly into the sulphur cream, stirring thoroughly until all the soda is in. Forty minutes later the resulting fluid can be poured into 100 gallons of water. (3) The prepared dip is additional to the 100 gallons. (4) You might mix the dip the night before, but it is better to prepare the dip on the day it is to be used. (5) Fresh dip should be made each day, but by carefully calculating what is left over you might use it again the next day, though such a course is not to be advised, and in any case the tank should be cleansed every second day. (6) The dip will certainly not keep more than two days. (7) The above answer your questions. The soda would corrode an iron tank.]

SCAB INFECTION.

To the Editor of the *Agricultural Journal*.

SIR,—Through a conversation I had with an inspector I found out why my sheep were rid of scab for three or four years. It is said that the shearers are accustomed to tie a piece of rag around the shears in order not to hurt their hands, and that they thus carry the scab insect from infected farms to clean farms; also in their clothes. In this way clean flocks are infected. I want to know when an inspector comes from an infected farm whether he cannot infect a clean farm by carrying the insect in his clothes. I understand this has been the case already. You must understand it is not an easy thing for the farmer to dip twice, to destroy his kraals, or to fence them, or to disinfect them. Cannot something be done to protect the practical farmer?—Yours, etc.,

G. J. VAN DER MERWE

Banksfontein, Griquastad.

[The Chief of the Sheep Division (Mr. B. Enslin) replies:—It is, of course, possible for scab parasites to be conveyed from place to place by shearers, but it is considered that the risk of this being done is very slight, and this Department is not aware of any case where the spread of infection could be attributed to an inspector having carried the parasite with him. The best thing a farmer can do to protect himself is to fence his property, and to allow no sheep to mix with his own until he has satisfied himself, by observation under isolation or by twice dipping at the proper interval of from ten to fourteen days, that scab is not present.]

INFLUENCE OF MONGREL COWS IN PURE BREEDING.

To the Editor of the *Agricultural Journal.*

SIR,—Could you inform me through your *Journal* whether in the event of a thoroughbred bull serving a mongrel cow first and then serving a thoroughbred cow (any breed) it does not in some way affect the calf of the second cow?

I do not ask this out of idle curiosity, but to settle a dispute.—Yours, etc.,

A. S. DEVENISH.

P.O. Boskop, District Potchefstroom.

[The Senior Veterinary Surgeon for the Transvaal (Mr. J. M. Christy) replies that there would be no influence. If a cow first threw a calf to a mongrel bull, and next year to a thoroughbred bull, we know that in some cases the characteristics of the mongrel appear in the calf begot by the thoroughbred. This condition is more marked and observable in dogs than in other animals; it has also been noted in the human species, the characteristics of a previous husband appearing in the children, the result of a second marriage.]

CASTING OF FLEECES.

To the Editor of the *Agricultural Journal.*

SIR,—Can you or any of your readers kindly inform me why merino sheep cast their wool?

Since last August about twenty-five of my sheep, all ages, have cast their wool. No symptoms are noticeable, except a rise of temperature in the early stages; otherwise the animal appears to be quite healthy.

Is this disease contagious?—Yours, etc.,

W. B. HUMPHREYS.

Belmont.

[The Chief of the Sheep Division (Mr. B. Enslin) replies:—It is considered that the sheep referred to cast their fleeces as a result of sickness. Sickness of any kind amongst sheep is usually accompanied by a certain degree of fever, and when fever is present the wool is apt to fall off. A veterinary surgeon should be consulted in future cases of this sort.]

SOME PIG QUERIES.

To the Editor of the *Agricultural Journal.*

SIR,—Will you please inform me which are the best types of lard pigs and where can they be obtained in South Africa. I would like a type of medium size, but with a tendency to put on fat.

I would also like to know if large blacks can be made very fat? I have several two years old, live weight about 250 lb., which I cannot get really fat.

Is my ration sufficient, viz., 2 lb. bran, 2 lb. mealies each per day, with as much roughage, in the shape of weeds, as they can consume?

I have given worm powders and sulphur occasionally.

Thanking you in anticipation.—Yours, etc.,

T. C. LEPPAN.

Blanco, P.O. Tarkastad, Cape Province.

[The Lecturer in Agriculture, Elsenburg School of Agriculture (Mr. P. Fowlie), replies:—I consider the Berkshire is the best breed of pigs for lard in

South Africa. Middle white Yorkshires are also good, but their colour is not so well adapted to South African conditions. There are herds of Berkshire pigs at the Government farms at Potchefstroom and here (Elsenburg). The Salvation Army farms near Capetown and Johannesburg are also large breeders. Numerous private farmers also keep Berkshires, and an advertisement in one of the agricultural papers would be sure to bring responses from some of these. Large black pigs are not easily made very fat, being more suitable for bacon than for lard pigs, but I consider Mr. Leppan's ration is quite insufficient for fattening purposes. When it is desired to fatten pigs it is advisable to shut them up and give them chiefly a grain ration. Pigs 250 lb. in weight will usually eat about 10 lb. of grain when put up to fatten. Of this amount three-quarters (say, 7 lb.) may be mealies or mealie-meal and the balance wheat or middlings or any kind of peas or beans that may be available. A little skim milk with the grain is a great advantage. Whole mealies are suitable at the beginning of the fattening if well soaked, but towards the end when the pigs have become rather fat and lazy meal should be given. Soak it twelve hours or so, but do not boil it.]

VELD-BURNING.

To the Editor of the *Agricultural Journal.*

SIR,—In the April number of the *Journal* you print a very strong condemnation of veld-burning. You show it is bad and only bad. I am not going to put up a fight for the practice; no doubt on the up-country farms it is all as you say, but I should like information as to what is to take the place of burning on our Natal coast farms. The Natal coast belt has good grass, it is green all the year round, and no frost worth speaking of, so is to be considered to be the coming dairy land of the Union; the more reason, therefore, to treat our veld properly. Here is the position: Our veld is very mixed, good grasses and heavy coarse ones growing together. If we feed down the good grasses and keep them fed down and do not burn, the coarse ones flourish and seed unchecked to the great advantage of the bad grass. Then our heavy tambuti lands give a good grass when burnt off and young, but as soon as it is old nothing can be done with it but burn it, and it could not be kept eaten down or mown. Thirdly, now the ticks are gone no one burns as aften as they used to, with the result that much of our best veld is being ruined by scrub springing up all over the country. If left to itself it might make forests of value in a few hundred years time, but as we want grass now that offers no attraction. If you walked over your best grazing land and saw hundreds of little patches of scrub springing up, killing out your red hay grass, how would you deal with the situation? As the matter is of really great importance a reply will greatly oblige.—Yours, etc.,

NATAL COAST.

To the Editor of the *Agricultural Journal.*

SIR,—May I be permitted to make a few remarks on the last paragraph of your editorial note, bearing on the subject of grass-burning, in your issue of April.

Your very ably written article does not prove, and previous writers following your line of thought have not proved, that grass-burning at the proper season, viz., early spring, causes the "coarsening of the grasses of which the veld is composed." Also, have you an example in proof of your statement: "Good veld, well cropped by stock but not overcrowded, and untouched by fire comprises a number of species of grasses: fine, nutritious kinds, and coarse and less palatable sorts. Burn off your veld every year and you gradually kill out all the best and finest species, reducing it to a few kinds of coarse, relatively innutritious varieties."

My own experience does not bear out the above, but goes to prove the contrary. I shall endeavour to prove my contention. I shall first deal with cultivated grasses.

If these are mown before seeding their years of life are prolonged, and the farmer receives a greater annual return of hay. But if seeding is allowed to any extent the grass dies out. Again, if it is cropped by stock sufficiently to prevent its seeding it becomes patchy and gradually dies out.

So that seeding and severe grazing are to some extent detrimental to their longer life. I have found this to be the case with oats, rye grass, lucerne,

etc. The natural trend of most grasses is to grow to seed and then die; if this trend or tendency is checked the growth, or period of piving, is extended. And the question of fresh plants growing from seed would depend upon the receptive nature of the ground, rainfall, sunshine, expanding or growing room, and many other causes.

If therefore follows that if perennial grasses were required to grow for many years it is necessary to keep them from seeding, and to keep a clear growing surface, by removing all overgrowth at the proper times and seasons.

With respect to my observations on veld conditions I find that the veld seeds but little unless it has not been burnt off for one season, when it seeds heavily. Thereafter it becomes a mass of worthless straw, and gradually dies out, leaving only the strong growing, and useless for grazing, coarse grasses which are better able to force a growth through the tangle of dead trash. I have examples in support of this. There are on this, and many other farms, some portions of ground which, for reasons I need not enter into, are never burnt off, and on these unburnt areas nothing remains of the sweet, fine grass, grasses which would be more suitable for firing a locomotive than feeding to stock are now to be found.

The majority of veld grasses do not depend on seeding to procure an annual growth, consequently it is not necessary for them to seed. As seeded grass becomes hard and woody, it is better to check seeding by some judicious means which is not harmful to the growing power of the grass; and for this spring burning is necessary.

This past season, owing to the lateness of the first rains, my stock was kept grazing on the dry veld later than usual, and in consequence some of my paddocks were grazed too short to burn, and these do not compare favourably with the paddocks that were burnt off. And the young grass on the unburnt area was fully two weeks later in springing after the first showers of rain fell.

I am convinced from practical experience and examples that grass-burning between the end of July and the middle of November at latest does not injure the veld, but on the contrary is beneficial to its better growth and feeding value.

The question of the loss of humus by burning the dead grass, and its relationship to the improvement of the veld, is a theoretical one which has not been proven by practical tests. While I am strongly in favour of spring-time burning I am absolutely opposed to burning at any time from the middle of November to the latter end of July. And I also think the system of intensive grazing as a means of removing the overgrowth exposes the root crowns of the grass too much to the severity of the winter and late springs. It is not practical to compare close grazing of wet England to dry South Africa.—Yours, etc.,

CHAS. R. SKOTTOWE.

Mooi River, Natal.

[Further reference to this question of veld-burning will be found in the Editorial Notes in this issue.—Acting Editor, *Agricultural Journal.*]

EARLY-MATURING MAIZE.

To the Editor of the *Agricultural Journal.*

SIR,—The *Journal* for March seems more interesting than ever and more especially the Editorial Notes. My object really in writing is in reference to the maize grown by Mr. Burtt-Davy in regard to which you say on page 371 that he reaped dead-ripe ears in eighty-two days.

It may interest you to know that I have also a very early mealie. I am three days ahead of Mr. Burtt-Davy, and had better care been taken perhaps more than three days.

On the 11th November, 1912, I planted about 3 lb. weight of yellow mealies, and on the 29th January, 1913, I picked three ears, also dead ripe, and within a few days cleared the patch. The three ears have been planted by a neighbour, and are doing very well. About fifty of the other ears have been planted by a farmer under the Magaliesberg, but as I do not often see him I cannot say how they are doing, but I am to have a return, so will know in time.

In 1911 I planted the seed from one ear. This ear was about 4 or 5 inches long and given by a friend who had no record as to where it came from, but declared that it was a sixty-day mealie. I did not place much faith in the

almost forgot to plant them. However, I planted, and no care of the mealies. They appeared withered and dead when the others mealies alongside of them) were still green. I occasionally collected some and gave them to the fowls. One day in February I was planting potatoes, and having one of these ears of mealies with me, I planted a row with the potatoes. They grew and produced the seed that gave the above-mentioned result. They are anything but good in appearance. They are bushy in growth, and have many blind ears on the bush; occasionally a good ear is formed. I hardly think they will be a profitable mealie, although I intend to give them a real good trial next season. You are very welcome to a few if you so desire. These mealies were grown in sandy soil.—Yours, etc.,

M. C. Jamieson.

Bockenhoutfontein No. 81,

P.O. Wonderboom.

[Mr. Burtt-Davy is away on long leave at present, but we feel sure he would be glad to have some of the seed Mr. Jamieson kindly offers for trial at one of the experiment stations.—Acting Editor, *Agricultural Journal*.]

STARTING WITH LUCERNE.

To the Editor of the *Agricultural Journal*

Sir,—I am desirous of obtaining information on the best method of cultivating lucerne. I have tried to get books on the subject but have failed to do so Would you therefore kindly inform me (*a*) what soils are most preferable; (*b*) the best manure to use; and (*c*) *re* irrigation: if large quantities of water and frequent watering are advisable.

By giving me the above information you will oblige,—Yours, etc.,

F. W. Alexander.

P.O. Box 1024, Robinson Mine.

[The Principal of the Potchefstroom School of Agriculture (Mr. E. J. Macmillan) replied:—I am sending correspondent a pamphlet giving information concerning this crop. (*a*) A deep alluvial soil is best, but any deep soil with a moderately open sub-soil is suitable (*b*) Lime is the chief fertilizing constituent necessary; at least 500 lb. of quicklime should be applied per acre. You would do well to make a trial at first on a carefully prepared piece of ground without manure. Irrigation every three weeks is advisable during the growing season. When rains are heavy irrigation may be withheld.]

MAIZE STALK BORER.

To the Editor of the *Agricultural Journal*.

Sir,—I read with much interest an article headed "The Maize Stalk Borer and its Control," by Mr. William Moore, which appeared in your March issue. I note his explanation of the different kinds of worm. I was always under the impression that they were only in two kinds, viz., the cutworm (underground) and the borer (on the surface). However, Mr. Moore advises that planting mealies late is also a preventive measure. He will be surprised to hear the experience I had with a bag of Early Leaming Mealies planted on the 23rd and 24th December, 1912. They were up in four days' time from the day they were planted; the quickest I have ever seen mealies appear above the surface. We had some good rains in December, January, and February, and the mealies came on so well that I thought I was going to have a kind of record crop from them. But towards the end of January last, in passing by them, I noticed an occasional mealie plant with the tips and three or four of the leaves turned dry, and on examination, I found it full of worms. A week or so later I again examined them, and found that the whole patch of mealies was simply infested with worms from one end of the land to the other. On pulling the tips of several plants I found worms in the tips to the number of fifteen and twenty. The stalks were infested with worms from base to tips. I have never had such an experience with worms before; about 95 per cent. of the mealies are affected. It may be that the worm has an inclination for this particular kind of mealie. I think mealies must be planted in November month,

Winter ploughing, I have found, is a very successful way of lessening the worms. Of course, I plough the lands twice, winter and summ[illegible] find out how these mealies are now so full of worms, unless it is because [illegible] were planted against a patch of mealies planted in November last which had worms, but only about 30 per cent. against 95 per cent. in the Early Leaming.

Thanking you for this insertion,—Yours, etc.,

W. G. F. ANDREWS.

Amor, P.O. Clocolan, Orange Free State.

[The Lecturer in Entomology at the Potchefstroom School of Agriculture (Mr. W. Moore) replies:—I would like to refer correspondent to my article, which will explain his experience. I advised planting late in November to miss the first brood, but he will find that the second brood, which is always the most numerous, makes their appearance late in January or early in February. His crop planted on the 23rd and 24th December, must have been in prime condition for attack of the borer which had been breeding in his November mealies which adjoined this field. The stalk borer emerged later than normal in 1912, and in many cases they did not appear until January, 1913.]

WHEAT FOR DRY FARMING.

To the Editor of the *Agricultural Journal.*

SIR,—As I intend experimenting on dry-land wheat growing I would be thankful for your advice as to what kind of wheat to sow to yield the best result.

The soil is dark red, light (not heavy), and retains moisture for a longer period than other parts of the farm. In the meantime I am ploughing the ground between 8 and 9 inches deep, and will harrow it once; then will disc harrow and sow, covering it with the tooth drag harrow. It is new ground, therefore clean. I will also try a few bags of Algerian oats alongside of the wheat, or any other oat you may deem better suited for winter growing on this place. This is in Potchefstroom District; high veld; average rainfall 30 inches.

Thanking you in anticipation,—Yours, etc.,

E H. STEPHENS.

P.O. Koster.

[The Dry-land Agronomist (Mr. H. S. du Toit) replied:—Up to the present the following wheat varieties have given the best results on this station (Lichtenburg):—Durums: "Chernouska," "Apulia," "Kubanka," "Belotourka," and South African "Zwart Baard." Soft varieties: "Kufoid," "Federation," and "Holstrooi." Oats: Algerian and Sidonian. We have no more seed wheat for sale, but we can supply you with Federation (a soft white variety), which has done very well on dry lands. Price 35s. per 200 lb. free on rail, Lichtenburg. I note that your ground is a sandy loam, and I would advise you not to put too large an acreage under oats at the start. Just try a few acres and ascertain the result. Dry-land wheat may be sown on a larger scale, provided your seed-beds have been prepared according to the dry-land system. We generally prepare our seed-beds for oats, wheat, etc., as much as possible at the very beginning of the rainy season, in order to arrest and retain as much moisture as possible during the succeeding rainy months, enabling the crops to grow and mature (if necessary without further help of rain) upon the moisture so conserved. We plant more or less drought-resistant seed wheat. I note that you have prepared your lands in April only; still it is quite possible that you have sufficient moisture to grow and mature crops upon. This is largely dependent upon the depth and nature of your soil. I would certainly not advise you to cover your seed with a tooth harrow, because this implement will not put your seed in deep enough. Your dry mulch on the surface of your kind of soil will be about 2 to 3 inches thick, and your harrow will allow some seed to remain in the upper dry soil mulch. Much as I dislike the idea of disturbing the moisture bed (in your ploughed stratum) I nevertheless feel convinced that in the absence of a seed drill you will do much better to plough the seed under—say about 5 inches deep—and harrow your land as soon as possible after the plough has covered the seed. You may use a disc or any other plough. A grain drill is, of course, the right thing.]

VALUE OF STABLE MANURE.

To the Editor of the *Agricultural Journal.*

SIR,—Are the ashes of burnt cow's droppings of any manurial value (in the vegetable garden)? How should they be applied—I mean, to what extent? Is stable manure mixed (horses and cows) suitable for citrus trees? And do these trees require manure at all?

If the Department will give me information on these points I will be obliged.—Yours, etc.

Dr. T. N. STUART.

Napier.

[The Horticulturist at Elsenburg School of Agriculture (Mr. I. Tribolet) replies:—I would reply to first question "Yes," although of low grade as compared with the burnt droppings of other farm animals. They contain a certain amou it of potash, lime, and phosphoric oxide. Put on anything up to a ton to the acre. To both questions *re* citrus trees I also relpy "Yes." Give them anything up to twelve tons to the acre, but do not put it near the stems of the trees.]

The Weather.

By C. STEWART, B.Sc., Chief Meteorologist, Department of Irrigation.

THE mean air temperature over the Union during the month of April was slightly more than 1 degree above the normal, due to higher night temperatures. A few frosts of no importance occurred.

The rainfall generally approximated the normal, being below in Natal and the Cape—excepting along the east of the Karroo—well above in the Transvaal, and varying but little in the Orange Free State. The distribution over the month was rather uneven, a marked feature being the continuous rains inland at the middle. The year's rainfall (since 1st January) is now generally in excess of the average.

JULY WEATHER CHARACTERISTICS.

Over the Cape Peninsula the rainfall is at its maximum during the month of July, and about 6·5 inches may be expected. In the adjoining south-western districts and along the west coast the amount of precipitation should vary but little from that of the preceding month; but along the south coast there may be quite an appreciable diminution, and probably 1·5 inches will not be exceeded. Over almost all other parts of the Union, the minimum for the year should be reached; the month may, indeed, be quite rainless, with sunny warm days and cold cloudless nights.

With the sun on its return journey, the day temperature should slightly increase, except in the south-west of the Cape, where the rainfall exercises an influence. The nights are, however, colder, and the result is a general decrease in the mean air temperature as compared with June. The normal mean temperature is about 59° over the Transvaal low veld, 57° along the south coast, 56° in the south-eastern districts, 55° over the Cape Peninsula, 53° along the west coast, in Kaffraria, over the east-central Karroo and the south-west of the Cape, and in Natal, 51° over the southern Karoo, 50° over the west-central Karoo and the Cape northern borders, 49° over the Transvaal high veld, 47° over the Cape north-eastern districts, 46° in the Orange Free State and Basutoland, and 45° in the northern Karoo. Frosts are frequent.

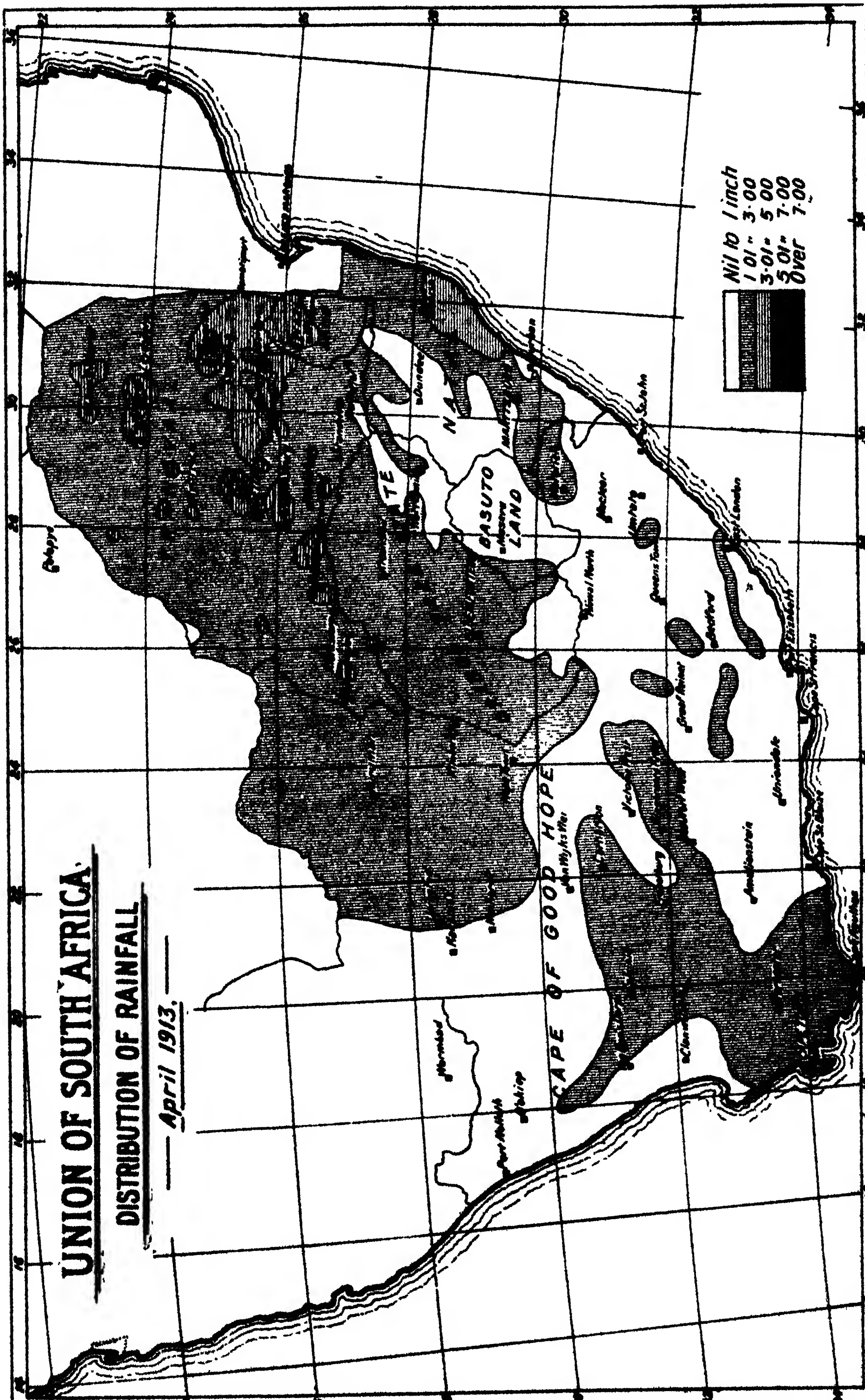
The prevailing winds are from the east-north-east in the north, and from north to north-east in the south-east of the Cape Province, while in the Transvaal they are from the north-west.

RAINFALL RETURN FOR APRIL, 1913.

Place.	Observer.	Month. April, 1913.	Month. Normal.	Month. Difference from Normal.	Year. From 1st Jan., 1913.	Year. Normal.	Year. Difference from Normal.
Transvaal—		ins.	ins.	ins.	ins.	ins.	ins.
Komatipoort ...	H. J. Evans ...	3·25	1·76	+1·49	14·23	15·35	—0·11
Christiana ...	S. W. Davis ...	3·45	1·71	+1·74	14·73	11·97	+2·76
Belfast	G. J. Imrie ...	3·35	1·44	+1·91	17·06	15·92	+1·14
Pilgrims Rest ...	E. Elphinstone ...	6·41	2·44	+3·97	22·92	24·57	—1·65
Zeerust	H. Dietrich, J.P....	2·27	1·46	+0·81	13·84	14·39	—0·55
Middelburg ...	Dr. H. A. Spencer	2·64	1·56	+1·08	12·10	14·42	—2·32
Potchefstroom ...	J. R. Stenning ...	2·76	2·11	+0·65	12·70	14·02	—1·32
Pretoria	J. Lyall Soutter...	2·29	1·79	+1·50	17·58	17·31	+0·27
Standerton ...	A. von Backstrom	2·48	1·45	+1·03	15·55	14·35	+0·20
Pietpotgietersrust	S.A. Riflemen ...	1·41	1·03	+0·39	16·65	13·24	+3·41
Johannesburg ...	Observatory Staff	2·23	1·44	+0·79	12·44	15·98	—3·54
Louis Trichardt ...	Sgt. J. C. M. Clark	3·45	2·02	+1·43	17·33	16·78	+0·55
Pietersburg ...	W. Frankleyne ...	3·03	1·29	+1·74	13·57	9·73	+3·84
Leydsdorp ...	E. E. McCusker ...	2·84	2·41	+0·43	—	—	—
Piet Retief ...	W. A. Humphries	3·16	2·47	+0·69	17·78	18·58	—0·80
Swaziland—							
Mbabane... ...	Swaziland Police	3·63	3·08	+0·55	26·95	26·41	+0·54
Natal—							
Maritzburg ..	Govt. Asylum ...	1·12	1·74	—0·62	29·91	15·29	+14·62
Dundee	The Gaoler ...	0·42	2·55	—2·13	17·87	18·00	—0·13
Hlabisa	E. D. Lightening	3·53	3·68	—0·15	33·74	17·32	+16·42
Port Shepstone ...	A. B. Cox ...	0·28	6·36	—6·08	28·85	21·43	+7·42
Bulwer	A. Brown ...	1·30	—	—	30·19	—	—
Durban (Point) ...	A. J. O. Andreasen	2·26	3·04	—0·78	40·63	16·70	+23·93
Cape—							
Mafeking ...	A. Webster ...	1·09	2·16	—1·07	12·22	12·17	+0·05
Vryburg	J. T. Morrison ...	2·15	1·99	+0·16	12·12	18·15	—6·03
Griquatown ...	E. Hanstein ...	2·54	1·86	+0·68	11·28	8·85	+2·43
Prieska	M. Drummer ...	1·48	1·71	—0·23	7·27	6·56	+0·71
Fraserburg ...	P. J. Booysen ...	2·10	1·04	+1·06	6·93	3·88	+3·05
Clanwilliam ...	W. J. Downes ...	0·53	0·77	—0·24	0·53	1·58	—1·05
Calvinia	W. Harvey ...	1·27	1·15	+0·12	1·67	2·63	—0·96
Piquetberg ...	A. H. Morris ...	1·60	1·77	—0·17	2·18	3·29	—1·11
Britstown ...	P. A. Myburgh ...	0·84	1·54	—0·70	7·76	6·47	+1·29
Carnarvon ...	J. Sullivan ...	0·96	1·15	—0·19	4·98	5·29	—0·31
Murraysburg ...	A. Cameron ...	1·68	1·08	+0·60	7·58	6·53	+1·05
Hanover	W. J. Myburgh ...	0·96	1·83	—0·87	6·87	8·46	—1·59
Aliwal North ...	A. Brown ...	0·79	2·23	—1·44	9·69	13·98	—4·29
Queenstown ...	H. Holley ...	0·82	1·71	—0·89	13·64	13·21	+0·43
Kokstad ...	H. D. Coyte ...	0·21	1·55	—1·34	17·58	13·32	+4·26
Port St. Johns ...	F. J. Lloyd ...	0·46	2·95	—2·49	38·11	18·25	+19·86
Worcester ...	W. B. Sutton ...	0·82	1·08	—0·26	1·12	2·29	—1·17
Capetown Observ.	The Staff... ...	2·37	2·16	+0·21	3·70	4·71	—1·01
Wynberg ...	Sister Mary Imelda	2·50	2·79	—0·29	4·56	5·83	—1·27
Swellendam ...	H. Montgomery...	1·84	3·18	—1·34	4·82	11·28	—6·46
Mossel Bay ...	G. Draper ...	0·28	2·09	—1·81	2·60	6·08	—3·48
Beaufort West ...	J. E. Stevens ...	0·86	0·83	+0·03	6·14	4·44	+1·70
Uniondale ...	E. J. Stewart ...	0·29	1·20	—0·91	4·67	4·55	+0·12
Knysna	Chas. Wilding ...	0·10	1·96	—1·86	3·96	8·50	—4·54
Graaff-Reinet ...	J. A. Simpson ...	0·39	1·16	—0·77	9·15	7·63	+1·52
Steytlerville ...	P. R. de Wet ...	0·39	0·76	—0·37	10·20	4·29	+5·91
Port Elizabeth ...	P. E. Morgan ...	0·18	1·77	—1·59	6·66	5·34	+1·32
Bedford ...	T. C. Hall ...	0·96	2·27	—1·31	13·94	13·04	+0·90
East London ...	Capt. M. C. Grogan	0·43	2·30	—1·87	15·50	9·50	+6·00
Hopetown ...	C. B. Scott ...	1·00	1·33	—0·33	6·84	8·14	—1·30
Orange Free State—							
Bloemfontein ...	J. Arndt	2·65	1·85	+0·80	11·12	13·13	—2·01
Harrismith ...	J. B. Patterson ...	0·33	1·89	—1·56	11·64	14·64	—3·00
Lindley	Jno. Oates ...	1·79	2·21	—0·42	9·64	13·51	—3·87

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN THERMOMETER SCREENS)—APRIL, 1913.

Place.	Observer.	Month—April, 1913. Mean Max.	Mean Min.	Monthly Temperature.	Normal Monthly Temperature.	Difference from Normal.	Extremes. Highest.	Date.	Lowest.	Date.
		°	°	°	°	°	°		°	
Transvaal—Louis Trichardt ...	Sergt. J. C. N. Clark	76·7	57·4	67·0	64·2	+2·8	91·0	5th	51·0	12th & 26th.
Pietersburg	W. Frankleyne ...	76·4	55·6	66·0	63·3	+2·7	86·0	4th & 5th.	45·0	30th.
Zeerust	H. Dietrich, J.P. ...	77·0	52·7	64·8	63·8	+1·0	84·0	5th	44·5	27th.
Pretoria (Arcadia) ...	J. Lyall Soutter ...	76·3	51·2	63·8	62·9	+0·9	83·6	5th	43·3	25th.
Belfast	G. J. Imrie... ...	67·3	45·1	56·2	55·6	+0·6	72·8	5th	35·0	27th.
Mbabane (Swaziland).	A. C. Hulett ...	71·9	57·3	64·6	62·4	+2·0	80·0	4th & 5th	46·0	25th.
Johannesburg (Obser.)	Staff	68·9	51·5	60·2	58·8	+1·4	74·9	24th	43·2	19th.
Potchefstroom ...	J. B. Stenning ...	77·2	51·0	64·1	61·5	+2·6	83·0	10th	43·0	21st.
Komatipoort	H. J. Evans ...	85·3	65·5	75·4	73·0	+2·4	99·0	5th	57·0	25th.
Free State—Bloemfontein	J. Arndt	72·6	49·3	60·9	57·7	+3·2	80·7	3rd	38·8	7th.
Lindley	J. Oates	73·0	47·0	60·0	58·8	+1·2	79·5	23rd	35·0	7th.
Harrismith	J. B. Patterson ...	69·0	47·3	58·1	56·0	+2·1	75·0	4th	37·0	7th.
Cape—Hanover	A. Kershaw... ...	63·9	41·5	52·7	57·3	—4·6	75·0	4th, 17th, & 30th	30·0	15th & 21st.
Aliwal North	A. Brown	77·9	43·5	60·7	59·0	+1·7	85·0	23rd	33·0	7th.
Kokstad	H. D. Coyte ...	70·5	46·4	58·4	59·4	—1·0	83·2	21st	37·0	30th.
Clanwilliam	W. J. Downes ...	81·0	53·0	67·0	67·2	—0·2	100·0	14th	43·0	7th.
Queenstown	H. Holley	76·9	48·2	62·5	61·9	+0·6	84·0	3rd	39·0	9th.
Bedford	T. C. Hall	77·5	51·5	64·5	63·2	+1·3	90·0	3rd	40·0	7th & 21st.
East London	M. C. Grogan ...	74·2	59·2	66·7	66·2	+0·5	83·0	20th	50·0	21st.
Capetown (Observatory)	Staff	71·3	51·8	61·5	63·1	—1·6	88·1	13th	43·2	4th.
Wynberg	Sister Mary Imelda	73·4	50·2	61·8	62·8	—1·0	91·5	13th	43·0	7th.
Mossel Bay	G. Draper	78·4	59·9	69·1	64·4	+4·7	86·0	14th & 15th	48·0	9th.
Port Elizabeth ...	P. E. Morgan ...	75·0	58·0	66·5	65·5	+1·0	92·0	15th, 16th, & 22nd	51·0	22nd.
Natal—Maritzburg	Govt. Asylum ...	79·5	55·4	67·4	67·8	—0·4	90·0	25th	48·0	24th.
Dundee	T. Kenny	78·7	52·7	65·7	63·9	+1·8	88·0	11th	48·0	24th.
Hlabisa	E. D. Lightening ...	80·5	60·5	70·5	—	—	83·0	5th, 6th, 7th, and 17th	59·0	12th.


UNION OF SOUTH AFRICA.
DISTRIBUTION OF RAINFALL
April 1913.
Nil to 1 inch
1·01 - 3·00
3·01 - 5·00
5·01 - 7·00
Over 7·00
BASUTO LAND
CAPE OF GOOD HOPE

South African Produce Markets.

CAPETOWN.

The Produce Department of the firm of R. Müller, Capetown, reports under date of the 29th May, 1913, as follows :—

Ostrich Feathers.—Next week the London auction sales will be held. On account of the uncertainty as to the turn which the market will take in London, the local market is somewhat restricted. But, for all that, sellers have every reason to be satisfied with the prices which obtain in Capetown. This is largely due to the local trade, which is constantly increasing, promising to become of the greatest importance. There is no other place in South Africa where the local industry has developed to such an extent as we find it in Capetown.

Moderate quantities have been disposed of in Capetown both by public auction and out of hand.

The following are to-day's quotations :—

	£	s.	d.		£	s.	d.
Primes	18	0	0	to	28	10	0
First	10	10	0	„	15	10	0
Second whites	8	0	0	„	10	0	0
Third whites	4	0	0	„	7	10	0
Inferior and stalky whites	2	0	0	„	5	0	0
Byocks and fancy	3	10	0	„	10	0	0
Superior feminas	12	0	0	„	15	10	0
First feminas	8	10	0	„	11	0	0
Second feminas	5	0	0	„	8	0	0
Third feminas	3	0	0	„	4	10	0
Greys	3	10	0	„	9	10	0
White boos	2	0	0	„	3	0	0
Light boos	1	0	0	„	2	0	0
Dark boos	0	5	0	„	0	17	6
Inferior boos and tipless	0	5	0	„	1	0	0

	£	s.	d.		£	s.	d.
Long blacks	3	0	0	to	6	0	0
Medium blacks	1	10	0	„	2	10	0
Short blacks	0	5	0	„	1	0	0
Long floss blacks	1	10	0	„	2	0	0
Medium floss blacks	0	17	6	„	1	10	0
Short floss blacks	0	5	0	„	0	10	0
Long drabs	2	0	0	„	3	0	0
Medium drabs	0	10	0	„	2	0	0
Short drabs	0	2	6	„	0	7	6
Long floss drabs	1	15	0	„	2	5	0
Medium floss drabs	0	17	6	„	1	10	0
Short floss drabs	0	5	0	„	0	10	0
Inferior long blacks and drabs	0	15	0	„	2	0	0
Common blacks and drabs	0	2	0	„	0	5	0
Spadonas	1	0	0	„	5	10	0

Wool.—Only small quantities of wool have been offered for sale in this market, which is quite a usual thing at this time of the year, as shearing mostly will be postponed until after the cold weather has ceased.

Prices now ruling are as follows :-

	d.		d.
Calvinia, long	6¼	to	7
Calvinia, medium	6	„	6½
Karroo and Roggeveld	6	„	9½
Short burry wools, heavy	4	„	4¾
Short burry wools, light	4¾	„	5½
C. and C., best grease	4¾	to	6
C. and C., medium	3½	„	4¾
C. and C., inferior	1	„	3
Malmesbury	5¾	„	6¾

Skins.—Fairly large quantities of skins have been offered for sale and sold in Capetown, whence they mostly have been exported to London. I am glad to be able to report again that all and any quantities consigned to Capetown are being taken up immediately at highly satisfactory prices, as per subjoined quotations :

Goatskins, light	1s. 1d. per lb.
Goatskins, medium	11d. per lb.
Sundried and kids	8d. per lb.
Angoras	7d. per lb.
Angoras, bastard	10d. per lb.
Angoras, shorn	5½d. per lb.
Caledon	7d. per lb.
Longwools, Karroo	6½d. per lb.
Shortwools	5½d. per lb.
Pelts and damaged	4½d. per lb.
Capes, large	3s. 1d. each.
Capes, medium	2s. 6d. each.
Capes, cut	1s. 6d. each.
Capes, damaged and lambs	7d. each.

Hides.—The Capetown market continues strong. No difficulty whatever is experienced in finding purchasers, who are paying for sound hides 10d. per lb., and for damaged 7d. to 8d. per lb.

EAST LONDON.

The Produce Department of Messrs. Malcomess & Co., Ltd., write as follows under date 29th May, 1913:—

Since our last lines dated 28th ult. were written Coleman Street has seen the close of the third series of London colonial wool sales which opened on the 22nd ult.

Approximate quantities that were available for the series were as follows:—

	Available.	Catalogued.	Held over.
Australians	174,000 bales	135,875 bales	46,000 bales
Capes	13,000 „	11,259 „	2,000 „
	187,000 bales	147,134 bales	48,000 bales

but of the Australians held over fully half are crossbreds.

There was a good attendance of buyers throughout, and keen competition, particularly from the home trade. The closing cable came through as follows:—

Long heavy combing grease	Mostly ½d. lower
Long super combing grease	Firm, but not quotably higher
Snow-whites	„ „ „ „
Shorts (of which very few availacle)	„ „ „ „

and this was amplified by the mail news just to hand from which we learn that the bulk of Cape and Natal wools consisted of heavy combing grease which at the close were 5 per cent. below last series. Super light combings when free of fault met with better demand and fully maintained last sales' rates. Short grease were in very small supply and for the few lots offered very keen competition resulted, prices ruling in importers' favour. Snow-whites also were in very small supply, and though not quotably higher realized very full values.

For the next series the incoming mail already reports

81,800 bales Australians
4,200 „ Capes

86,000 bales available.

In Bradford quotations again stand at 29d. against a level of a farthing less a month ago. On the continent there is keen business at prices generally satisfactory to importers.

In the local market very considerable clearances have been made. Most well-conditioned longs are cleared out of the market, and shorts of the same type are very eagerly sought and command big money. Snow-whites, when bright, dry, and free, touched very high levels, and even lower grades (either burry or of discoloured nature) were very well paid for.

Quantities disposed are as follows:—

Week ending				
3rd May:	No sales held but wools sold privately			2,000 bales
	Bales.	Bales.		
„ „ 10th ..	3,700 offered,	1,500 sold.	Total for week,	2,500 „
„ „ 17th ..	1,800 „	1,000 „	„ „	2,200 „
„ „ 23rd „	900 „	700 „	„ „	2,200 „
„ „ 31st „	600 „	450 „	„ „	1,000 „
			a grand total of	10,000 „

leaving the stocks at a little over 5000 bales.

We quote:—

	d.		d.
Transkeis, when available, good clean dry lots	8	to	8½
Transkeis, when available, average parcels	7¼	„	8
Basutos, good to average lots	6¼	„	7⅛
Super short Kaffrarian farmers', nominal	8	„	10
Super long Kaffrarian farmers', when available	8	„	11
Super short well-conditioned grassveld	6	to	9
Super long well-conditioned grassveld	6½	„	9½
Short faulty grease	4½	„	7¼
C. and C. grease (good average)	5½	„	6¼
„ „ (very kempy to inferior)	3	„	5

Mohair.—A considerable advance in values has to be reported under this heading. This is chiefly due to the action of speculators, who seem to have a good opinion of the immediate future of this article. There is, however, no doubt that spinners have raised the limits for their orders too, and it is therefore apparently an indication that values are likely to be maintained for the present. Over 500 bales have changed hands lately.

We quote:—

	d.	d.		d.	d.
Good to best Basuto hair, sorted.	—		Super long summer firsts.......	12¾	to 13¼
Average Basuto hair...........	—		Super short summer firsts.......	12	„ 12¾
Sortings according to quality and length.....................	5½	to 7½	Super summer kids............	20	„ 25
Coloured hair, up to...........		6½	Average summer kids..........	16	„ 20

Sundry Produce.—The sundry produce markets have undergone some change again. There has been a slight revival in the hides market at the very end of the month, despite the fact that the hide sales in London showed a slight decline. Sheep have to be quoted a shade lower. Goat and Angora are unchanged, but the prospects do not seem quite favourable for goatskins. Our London house quote:—

Sheepskins and Angora-skins.....Think present prices safe.
Goatskins.......................Think prices will fall.
Hides...........................Think prices will advance for certain grades.

We quote:—

Sundried hides	12d.	Sheepskins—1st quality parcels.	6d.
Dry-salted hides..............	11d.	„ C. and C. skins....	5d.
Goatskins.....................	12d.	„ Do. including Capes	5½d.
Bastards......................	10d.	„ Pelts	4¼d. to 4½d.
Angora-skins..................	8d. to 8½d.	„ Transkeis	4¾d.
Damaged	5d. each.	Horns, according to quality and size (each).................	2d. to 3d.

DURBAN.

Messrs. Reid & Acutt's Wool Mart, Ltd., Esplanade, Durban, report as follows under date 29th May, 1913:—

Wool.—The past month has been a very quiet one on the local wool sales, the offerings having been extremely small. The market, however, has been brisk, and practically all classes have changed hands at good rates, particularly light-conditioned wools, values for which have been excellent.

The London sales closed on 7th inst., when we received the following cablegrams, viz.:—

"London, 7th May, 1913. Sales have closed. Prices, as compared with closing rates of last series (20th March), are as follows:—

Light combing grease..............................	2½% higher.
Heavy „	5% lower.
Light clothing grease..............................	2½ % higher.
Heavy „	2½ % lower.
Snow-whites, super,..............................	Unchanged.
„ average to good.......................	„
„ inferior and faulty	2½ % higher."

And:—

"Bradford, 7th May, 1913. Sales have closed: as compared with the closing rates of the previous series (20th March), we quote as follows:—

Good long combing grease	Unchanged.
Short combing grease............................	¼d. to ½d. lower.
Short clothing grease	Unchanged.
Snow-whites, medium	Par to ½d. dearer.

Good 64's Cape tops are worth here 29½d. per lb. In mohair Cape firsts are just holding their own and trade is quiet. Cape firsts of good fine character are worth here 13d. to 13½d. per lb."

Coarse and Coloured.—This remains in strong demand at fully maintained rates.

Mohair.—This market is strong and active with a full inquiry for all lots offered, prices being well maintained at our quotations as under. On our sale this week a parcel of kids' hair realized 18½d. per lb.

The following are the prices current here to-day :—

NATAL AND EAST GRIQUALAND.

Midlands.

	d.		d.
Sorted clips, light and clean ..	10	to	12
Unsorted clips, light and clean	9	„	10½
Short to medium lambs.......	7½	„	8½
Medium to long lambs........	8½	„	10

Nominal.

Utrecht and Vryheid.

	d.		d.
12 months' sorted clips, light and clean......................	8½	to	9¼
12 months' average clips, light and clean..................	7¼	„	7¾
6 to 9 months average..........	6½	„	7½
Short to medium lambs.........	7	„	8½
Medium to long lambs	8¼	„	9¼

Ladysmith, Newcastle, Dundee, etc.

	d.		d.
12 months' sorted clips, light and clean	9	to	10
12 months' average clips, light and clean..................	7½	„	8½
6 to 9 months average..........	6½	„	7¼
Short to medium lambs.........	7¼	„	8¾
Medium to long lambs	8½	„	9½

East Griqualand.

	d.		d.
12 months' sorted clips, light and clean......................	8¾	to	9¼
12 months' average clips, light and clean..................	7¼	„	7¾
6 to 9 months light and clean ...	6¼	„	7
Short to medium lambs.........	6¾	„	7¾
Medium to long lambs	7¾	„	8½

TRANSVAAL.

Volksrust, Wakkerstroom, Ermelo, Amersfoort, etc.

	d.		d.
12 months' sorted clips, light and clean......................	9	to	10
12 months' average clips, light and clean..................	7¾	„	8¾
6 to 9 months average..........	6½	„	7¾
Short to medium lambs.........	7¼	„	8½
Medium to long lambs	8	„	9¼

Standerton, Bethal, Middelburg, etc.

	d.		d.
12 months' sorted clips, light and clean	8	to	9
12 months' average clips, light and clean..................	7	„	7¾
6 to 9 months average..........	6	to	7
Short to medium lambs.........	6¼	„	7½
Medium to long lambs	7¼	„	8

Heidelberg, Pretoria, Potchefstroom, Klerksdorp, Lichtenburg, etc.

	d.		d.
12 months' sorted clips, light and clean......................	7½	to	8¼
12 months' average clips, light and clean..................	6½	„	7¼
6 to 9 months average..........	6	„	6¾
Short to medium lambs.........	5¾	„	7
Medium to long lambs	6¾	„	7½

ORANGE FREE STATE.

Harrismith, Vrede, Bethlehem, Heilbron, etc.

	d.		d.
12 months' sorted clips, light and clean......................	8	to	9¼
12 months' average clips, light and clean..................	7¼	„	8
6 to 9 months average..........	6¼	„	7¼
Short to medium lambs.........	6½	„	7¾
Medium to long lambs..........	7¾	„	8¾

Lindley, Kroonstad, Vredefort, Parys, etc.

	d.		d.
12 months' sorted clips, light and clean......................	7¾	to	8¾
12 months' average clips, light and clean..................	7	„	7½
6 to 9 months average	6	„	6¾
Short to medium lambs	6½	„	7½
Medium to long lambs	7½	„	8¼

Senekal, Ficksburg, Ladybrand, Winburg, etc.

	d.		d.
12 months' sorted clips, light and clean......................	7¾	to	8½
12 months' average clips, light and clean..................	6¾	„	7¼
6 to 9 months average	5¾	„	6½
Short to medium lambs	6¼	„	7¼
Medium to long lambs	7	„	8

Coarse and Coloured.

	d.		d.
Free from kemps.............	5¾	to	6½
Ordinary	4½	„	5½
Inferior, kempy, and Persian....	2	„	3½

BASUTOLAND AND NATIVE WOOLS.

	d.		d.
Superior lots, light and clean ...	6¼	to	7
Average lots, light and clean....	5½	„	6¼
Average lots, heavy and wasty ..	5	„	5½
Transkei, good	7	to	8¼
Transkei, ordinary.............	6	„	7

MOHAIR.

	d.		d.		d.		d.
Kids, good length and super quality	13	to	18	Good winter	9½	to	10½
Long blue, super quality	12	„	13	Short and mixed winter	8½	„	9½
Long blue, average	11	„	12	Inferior and coloured	3	„	6

BASUTOLAND AND NATIVE MOHAIR.

	d.		d.		d.		d.
Good length and quality	11	to	12	Inferior and short mixed	6	to	8
Average lots	10	„	11				

HIDES, SKINS, HORNS, ETC.

All descriptions are in good demand at our quotations as follows:—

Hides.—Sundried, 14 to 20 lb. average, 10½d. to 12d. per lb.; sundried, inferior, 8d. to 9d.; salted, 8½d. to 10d.

Sheepskins.—Long-woolled, 5½d. to 6½d. per lb.; short-woolled, 3½d. to 4½d; pelts, 1½d. to 3d.; coarse and coloured, 3d. to 5d.; salted, heavy, 4d. to 5½d.

Goatskins.—Mixed parcels, sound, 4d. to 6½d. per lb.; inferior, 2d. to 3d.

Horns.—3d. to 12d. per pair.

Wattle Bark.—Cut and bagged, good colour and quality, 4s. to 4s. 9d. per cwt.; cut and bagged, inferior colour and quality, 2s. 6d. to 4s. per cwt.: uncut in bundles, good colour and quality, 2s. to 3s. per cwt.; uncut in bundles, inferior, 1s. 6d. to 2s. per cwt.

Agricultural Show Dates, 1913.

Secretaries of Societies which propose holding shows during 1913, the dates of which do not appear in the following list, are invited to send particulars at the earliest opportunity.

TRANSVAAL.

Barberton, 11th July.

Klerksdorp.—No show owing to drought.

NATAL.

Ixopo, 19th June.
Umvoti, 20th and 21st June.
Alexandra, 24th June.
Pietermaritzburg, 25th to 27th June.
Durban, 2nd to 4th July (provisional dates).
Stanger, 9th July.
Richmond, 25th July.
New Hanover.—No show will be held.

Farm Employment.

Note.—This section is open to persons desiring to obtain employment on the land, and to farmers who require farm assistants. Notices are inserted in several succeeding issues; and advertisers are requested to advise the Editor as soon as their requirements are filled in order that their notices may be deleted.

SITUATIONS WANTED.

Management of farm wanted by experienced farmer; large and small stock and agriculture. Age 38. Ten years' South African experience.—M., Box 5230, Johannesburg. [3]

Applicant, 23 years of age, desires employment on farm as manager. South African born. Acquainted with general farming. Speaks Dutch and Kaffir, and English to some extent.—J. G. MAARTENS, P.O. Ida, via Indwe, C.P. [4]

Engine-driver wants job on farm; is used to shellers, thrashers, pumps, traction, etc Fair carpenter and all-round handy-man. Single.—C. A. RYALL, c/o Mrs. Heydenrych, 384 Schoeman Street, Pretoria. [4]

Employment wanted by Colonial, age 27, as manager or assistant on a farm. Has had good experience in stock and agricultural farming in Cape Province for years; also good knowledge of butter-making. Speaks both English and Dutch. Good references.—G. H., Box 18, Newclare, Johannesburg. [4]

Young man, with several years' experience both in stock and agricultural farming, desires situation as farm manager. Testimonials.—P. S. CAMPBELL, Fort Beaufort. [3]

Applicant, 30 years' experience in farming in South Africa in every branch, including ostriches, cattle, sheep, horses, general agriculture and fruit farming, wants position as farm manager. Speaks Dutch and English fluently. Excellent references.—ApplyH. D. VILJOEN, 17 Pretorius Street, Pretoria. [5]

English woman, holding first class certificate in dairy work, and having many years' practical experience, wishes to obtain work in creamery. Would undertake the management of a dairy, or any suitable employment. Has lectured and demonstrated for county councils in England.—C. G., c/o *Agricultural Journal* Office, Pretoria. [5]

Applicant, 27 years of age, German, desires position on farm in Transvaal as general manager, on salary or salary and share basis. Brought up on farm in Transvaal. Has thorough experience of general farming, cattle breeding, and dry-land farming. Has at present a position as manager, and receives £20 per month.—J. H. F., Box 14, Grootfontein North, German South-West Africa. [5]

Situation wanted as farm manager by a steady, reliable, and hard-working man, 31 years of age. Has had 15 years' experience in every branch of farming, thoroughly understands the management of natives. Competent sheep judge. Holds best of testimonials. Apply, stating salary, to "RENNOX," Grasslands, Cathcart, C.P. [5]

Advertiser, with Free State, Transvaal, and Rhodesian experience, desires post as manager. Age 33, married, one child. Good references as conscientious, capable worker.—A. F., *Agricultural Journal* Office, Pretoria. [5]

A healthy, steady young farmer, 29 years of age, unmarried, desires situation on farm. Born in South Africa, thoroughly understands farming in all its branches, cattle, sheep, and horses, also agriculture.—94, c/o G. H. COCKCROFT, P.O. Balfour, Heidelberg, Transvaal. [6]

Employment wanted by applicant, 40 years of age, with family. 25 years' experience in stock and agricultural farming. Will accept employment in any part of the Union.—D. J. ERASMUS, c/o G. Nel, 66 Delarey Street, Vrededorp, Johannesburg. [6]

A steady, healthy man of 26 years of age (married) desires situation on farm as manager. Thoroughly acquainted with general farming business. Speaks Dutch and Kaffir only.—J. L. FOURIE, Slaapkrantz, P.O. Clifford, Barkly East. [6]

A young English Colonial, age 21 years, with five years' practical farming experience with stock, agriculture, and general farming, desires situation as farm assistant.—Q. ROBINSON, jun., Grey Street, Dordrecht, C.P. [6]

Young colonial-born Englishman, age 18 years, desires position as learner on South African farm, Natal Province preferred. Strong, healthy, and willing to do any hard work.—EDWARD COX, Box 126, Pietermaritzburg. [6]

Scotsman (30), well educated, active, healthy, offers services in return for board, lodging, and nominal salary. Highest references.—GRANT, Box 4675, Johannesburg. [6]

Situation wanted on farm by married man, age 50 years. Has one son. Has experience of general farming. Testimonials can be given.—D. J. STEYN, P.O. Belfast, Transvaal. [6]

Learner on farm, age 26, with 5 months' sound experience in up-to-date farm work, wishes position with small salary and board.—EDGAR, Box 2247, Johannesburg. [6]

Applicant, age 24, desires position as manager or overseer of sheep farm. Good testimonials from leading Australian sheep-breeders.—T. PICKBURN, P.O. Box 2337, Johannesburg. [6]

SITUATIONS VACANT.

Opportunity for person with knowledge of gardening who would be prepared to cultivate, on his own account, portion of a farm in the Boshoff District of the O.F.S. Plentiful water supply and good soil. Terms to be arranged.—W., *Agricultural Journal* Office, Pretoria. [4]

Wanted, man with family on a farm where tobacco and cotton can be grown. All implements and draft animals will be provided. House with three rooms, and also a windmill on the farm. Communicate with J. TRICHARDT, jun., Mahabieskraal, P.O. Brakkloof, Rustenburg. [5]

Wanted on a farm, suitable for cultivation of tobacco, cotton, and maize, a young man of between 18 and 20 years of age. Part of crops will be given.—LOUIS G. TRICHARDT, P.O. Braakkloof, Rustenburg. [6]

Young man who wishes to learn farming wanted on a farm four hours from Middelburg, Transvaal.—F. J. VAN EEDEN, P.O. Boesmans Pan, Middelburg, Transvaal. [6]

The undermentioned offers (*a*) 80 morgen of arable land on half share. Owner will provide all implements, etc., except servants; (*b*) 200 morgen of uncultivated land at 1/3rd share; (*c*) six burgher-right erven at Belfast, situated near to or adjoining each other, and are suitable for growing potatoes. Can be had by paying annual rates and taxes on these erven. For (*a*) and (*b*) persons possessing some stock will receive preference.—R. A. KNIPE, P.O. Tweedronk, Standerton. [6]

Farmer on south coast of Natal, who has met with a shooting accident, is compelled to be absent for a long time and desires a person to take care of the property. He offers the use of several hundred acres of good land with plenty of water, some fruit trees, a dwelling-house, shed, tanks, complete equipment of implements, and a couple of trek-oxen free of rent. If desired, a term of years can be arranged.—C. ROSITZKY, Port Shepstone, Natal. [6]

Opportunity for young man to learn fruit farming and preserving.—L. REICHE, Houtboschdorp, P.B. Haenertsburg. [6]

Services required of thoroughly competent up-to-date farm manager for farm "Arensfontein," 8 miles from Middelburg (Transvaal).—POWER & GREATREX, Box 1384, Johannesburg. [6]

Importation of Live Stock.

Return showing particulars of certain Pure-Bred Live Stock recently imported into the Union of South Africa.

Stud-book No. or Name.	Breed and Stud-book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
HORSES:				
"Knight Bachelor," No. 2842	Thoro'bred.—New-market	Stallion	U.K.	Major K. P. Apthorp, Bloemfontein, O.F.S.
"Nuit Noire" ...	Thoro'bred.—Epsom	Mare	"	" "
"Othrae"	" "	"	"	" "
Not stated	Thoro'bred.—English Stud-book	Stallion	"	Percy Day, St. George's Street, Capetown.
CATTLE:				
"Zwart Ytje II," No. 13535	Fries.—Stud-book not stated	Cow	Holland	C. A. Schweizer, Burghersdorp, C.P.
"Guske IV," No. 16496	" "	"	"	" "
"Akke IX," No. 16497	" "	"	"	" "
"Alinke," No. 16789	" "	"	"	" "
"Dora XII," No. 16580	" "	"	"	" "
"Elke IV." No. 15092	" "	"	"	" "
"Afke IX," No. 17882	" "	"	"	" "
"Anna II," No. 1208	" "	"	"	" "
"Melkcron I," No. 14457	" "	"	"	" "
"Yonge Ceres," No. 5896	" "	Bull	"	D. V. Kannemeyer, Burgersdorp, C.P.
"Bontje III," No. 17940	" "	Cow	"	" "
"Pietje." No. 16303	" "	"	"	" "
"Rimschje," No. 17487	" "	"	"	" "
"Vunkje V," No. 1086	" "	"	"	" "
"Eeke III," No. 782	" "	"	"	" "
"V. d. Telde II," No. 27713 H.	" "	"	"	" "
"Pel II," No. 241338	" "	Bull calf	"	" "
"Emigrant," No. 557	" "	"	"	" "
"Thiemen VII," No. 5017	" "	Bull	"	Strachan & Co., Upper Umzimkulu, P.O. Ixopo, Natal.
"Frieslander," No. 5671	" "	"	"	" "
"Catharina," No. 17484	" "	Cow	"	" "
"Petronella," No. 17464	" "	"	"	" "
"Agathe V," No. 17481	" "	"	"	" "

Stud-book No. or Name.	Breed and Stud-book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
CATTLE (*continued*):				
"Rondorn," No. 16304	Fries.—Stud-book not stated	Cow	Holland	Strachan & Co., Upper Umzimkulu, P.O. Ixopo, Natal.
"Atje XXI," No. 17486	" "	"	"	" "
"Cynet," No. 26 ...	" "	"	"	" "
"Zukoba," No. 44 ...	" "	"	"	" "
"Floortje VIII," No. 1723	" "	"	"	" "
Four calves born on voyage.				
"Tinjeur Bles," No. 5856	" "	Bull	"	P. B. Wessels, Strydfontein, Ventersburg, O.F.S.
"Garypiter III," No. 1306	" "	Cow	"	" "
"Wilhelmina II," No. 1290	" "	"	"	" "
"Van Es V," No 1303	" "	"	"	" "
"Maartje VII," No. 47	" "	"	"	" "
"Altenburg II," No. 617	" "	"	"	" "
"Johannes," No. 6011	" "	Bull	"	J. D. van Niekerk, Brackfontein, Bedford, C.P.
"Age," No. 6010 ...	" "	"	"	R. Featherstone, Cheviotsdale, Venterstad, C.P.
"Pel XIV," No. 17483	" "	Cow	"	J. H. Cloete, Herbertshope, Bedford, C.P.
"Lentebode," No. 516	" "	Bull	"	" "
"Pel XX," No. 576	" "	Heifer calf	"	" "
"Sprenger X," No. 359	" "	"	"	" "
"Klein Pieke," No. 6058	" "	Bull	"	" "
"Pel Kleintje," No. 5676	" "	"	"	Van Aardt, Reitfontein, Aliwal North.
No. 15820	Fries.—Het Friesch Rundvee Stamboek	Cow	"	J. H. Gertzen, Middelburg, C.P.
No. 16633	" "	"	"	" "
No. 5 79	" "	Bull	"	" "
"Dairymaid," No. 10151	South Devon.—South Devon Herd-book	Heifer	England	Major K. P. Apthorp, Westminster, O.F.S.
"Dewdrop," No. 10154	" "	"	"	" "
"Dorothy VI," No. 11011	" "	"	"	" "
"Pansy IV," No. 11009	" "	"	"	" "
"Molly," No. 11014	" "	"	"	" "
"Dahlia VII," ...	" "	"	"	" "
"Trezare Dora," No. 10399	" "	"	"	" "
"Trezare Yellow Rose," No. 1217	" "	"	"	" "

Stud-book No. or Name.	Breed and Stud-book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
CATTLE (*continued*) :				
"Colonial's Buttercup," No. 11251	South Devon.—South Devon Herd-book	Heifer	England	Major K. P. Apthorp, Westminster, O.F.S.
"Lawlyre Madonna," No. 10784	" "	"	"	" "
"Lawlyre Doreen," No. 10783	" "	"	"	" "
"Lawlyre Sunflower"	" "	"	"	" "
"Briar Rose," No. 10239	" "	"	"	" "
"Rita," No. 10251...	" "	"	"	" "
"Blossom," No. 10238	" "	"	"	" "
"Doreen VI," No. 11070	" "	"	"	" "
"Violetta III" ...	" "	"	"	" "
"Golden Drop VIII," No. 10354	" "	"	"	" "
"Daisy," No. 11089	" "	"	"	" "
"Dahlia V," No. 7976	" "	Cow	"	" "
Calf	" "	Heifer	"	" "
"Woodford Don," No. 4252	" "	Bull	"	" "
"Painsford Counsellor"	" "	"	"	" "
"Painsford Nobleman"	" "	"	"	" "
"Lawlyre Captain"	" "	"	"	" "
"Shakespeare" ...	" "	"	"	" "
"Sir Rufus" ...	Red Shorthorn.—Coates Herd-book	"	"	Price Bros., Queenstown.
"Augustus" ...	" "	"	"	" "
"Crocus," No. 10142	South Devon.—South Devon Herd-book, vol. No. XII, p. 212	Heifer	..	D. W. Mills, Grootvlei, Steynsburg.
"Primrose 2nd," No. 10015	South Devon.—South Devon Herd-book, vol. No. XII, p. 198	"	"	" "
"Myrtle 4th," No. 9882	South Devon.—South Devon Herd-book, vol. No. XII, p. 182	"	"	" "
"Princess 6th," No. 9767	South Devon.—South Devon Herd-book, vol. No. XII, p. 169	"	"	" "
"Burton Horkstow Lady 3rd"	Red Lincoln Shorthorn.—Lincoln Red Shorthorn Associat. Stud-book, 9th and 13th Herd-book	"	"	R. P. Gregory, Sherwood, Molteno.
"Burton Horkstow Lady 4th"	Red Lincoln Shorthorn.—Lincoln Red Shorthorn Associat. Stud-book, 13th and 14th Herd-book	"	"	" "
"Burton Horkstow Lady 5th"	Red Lincoln Shorthorn.—Lincoln Red Shorthorn Associat. Stud-book, 11th and 13th Herd-book	"	"	" "

Stud-book No. or Name.	Breed and Stud-book in which Registered.	Sex.	Country of Origin.	Importer's Name and Address.
CATTLE (*continued*):				
"Burton Horkstow Lady 6th"	Red Lincoln Shorthorn.—Lincoln Red Shorthorn Associat. Stud-book, 13th and 15th Herd-book	Heifer	England	R. P. Gregory, Sherwood, Molteno.
"Burton Horkstow Lady 7th"	Red Lincoln Shorthorn.—Lincoln Red Shorthorn Associat. Stud-book, 13th Herd-book	"	"	" "
"Burton Horkstow Lady 8th"	Red Lincoln Shorthorn.—Lincoln Red Shorthorn Associat. Stud-book, 10th and 13th Herd-book	"	"	" "
"Burton Horkstow Lady 10th"	Red Lincoln Shorthorn.—Red Lincoln Shorthorn Associat. Stud-book, 13th Herd-book	"	"	" "
"Burton Horkstow Lady 19th"	Red Lincoln Shorthorn.—Lincoln Red Shorthorn Associat. Stud-book, 14th Herd-book	"	"	" "
"Shenstone Margins"	Shorthorn.—Coates Herd-book, vol. 59	Bull	"	Wm. Cooper & Nephews, Gonubie Park.
SHEEP:				
No. 1134	Wanganella.—Stud-book not stated	Ram	Australia	Harry Archer, Graaff-Reinet.
No. 1325	" "	"	"	" "
No. 1357	" "	"	"	" "
"Mariner 1" ...	Merino.—Stud-book not stated	"	"	Orpen & Son, Barkly East.
6 Rams	" "	Rams	"	W. T. Hopsett, Dordrecht.
2 Ewes	" "	Ewes	"	" "
No. 1591	Spanish.—Register of Vermont, N.Y., and Ohio Merino Sheep Breeders' Assn.	Ewe	U.S.A.	S. J. Marais, Dordrecht.
No 1574	Merino.—Register of Vermont, N.Y., and Ohio Merino Sheep Breeder' Assn.	Ram	"	" "

Current Market Rates of Agricultural Produce and Stock.

The following TABLE OF CURRENT MARKET RATES OF AGRICULTURAL PRODUCE AND LIVE STOCK on Friday, 30th May, 1913, ruling at the several Centres named, is published for general information.

Centre.	A. Wheat per 100 lb.	B. Wheat Flour per 100 lb.	C. Boer Meal per 100 lb.	D. Mealies per 100 lb.	E. Mealie Meal per 100 lb.	F. Barley per 100 lb.	G. Oats per 100 lb.	H. Oat-hay per 100 lb.	J. Lucerne Hay per 100 lb.	K. Potatoes per 100 lb.	L. Tobacco (Boer Roll) per lb.	M. Beef per lb.	N. Mutton per lb.	O. Fresh Butter per lb.	P. Eggs per dozen.	Q. Cattle (Slaughter).	R. Sheep (Slaughter).	S. Pigs.
Cape Province:	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	s. d.	£ s. d.
Aliwal North ...	11 6	23 0	30 0	20 0	22 0	15 0	16 0	7 0	6 0	25 0	1 0	0 8	0 6	1 0	1 6	12 10 0	15 6	*2 15 0
Beaufort West ...	13 0	19 0	13 6	8 9	13 6	11 0	8 3	4 6	5 0	10 6	1 0	0 5	†0 4	1 3	2 0	13 0 0	12 0	5 0 0
Capetown ...	8 0	—	—	—	—	8 0	6 4	4 6	1 3	11 0	§0 5½	—	—	1 3	2 0	—	—	—
East London ...	9 6	18 6	29 0	8 0	14 6	7 6	9 0	6 6	5 6	14 0	1 0	0 4	0 5	2 0	2 3	12 0 0	18 0	1 8 0
Grahamstown ...	11 9	—	—	9 0	—	7 0	6 6	8 2	—	9 6	0 9	0 5½	0 6½	1 8½	2 4½	—	—	2 8 0
Kimberley ...	11 6	15 9	16 3	8 0	9 6	10 0	7 6	5 6	6 0	10 0	0 5	0 6½	0 4½	1 2	2 0	12 0 0	14 0	4d.p.lb.
Kingwilliamstown	12 6	18 9	14 6	8 0	8 6	9 6	9 0	7 0	6 0	10 6	0 7	0 6	0 6	1 8	1 9	12 10 0	18 0	3d.p.lb.
Port Elizabeth ...	10 0	—	—	8 0	—	6 6	6 6	6 0	—	11 0	—	0 7	0 7	1 10	2 8	—	—	2 5 0
Queenstown ...	12 0	16 6	14 0	8 6	12 6	—	10 0	—	5 6	8 6	—	—	0 4½	1 3	2 6	—	—	—
Natal:																		
Durban ...	—	—	—	7 6	—	—	—	—	—	8 9	—	—	—	1 7	2 0	—	—	—
Pietermaritzburg	12 6	—	—	5 6	—	12 0	9 6	7 0	4 0	9 0	0 4	0 4½	0 5½	1 5	1 6	—	—	—
Transvaal:																		
Pretoria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Johannesburg ...	14 0	—	12 3‡	6 9	7 6	8 0	7 6	5 9	6 9	13 4	0 2¾	—	—	1 3	2 6	—	—	—
Orange Free State:																		
Bloemfontein ...	14 0	—	14 6	7 0	6 6	--	8 6	6 6	4 3	10 0	0 6	0 6	0 3	1 6	2 6	—	—	—
Harrismith ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Average, £2. 10s. to £3. † Average, 3d. to 5d. ‡ Sifted. § Average, 4d. to 7d.

Outbreaks of Animal Diseases.

THE following outbreaks of scheduled infectious and contagious animal diseases have occurred in the areas specified during the month ended 31st May, 1913.

C. E. GRAY,
Principal Veterinary Surgeon (Union).

CAPE PROVINCE PROPER.

(EXCLUDING TRANSKEIAN TERRITORIES.)

Disease.	District.	Area or Name of Farm.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Anthrax ...	Alexandria ...	The Post	1	40	—	—	—	—	—	—
	" ...	De Hoek	3	150	—	—	—	—	—	—
	Barkly West ...	Zoetlinntjes	1	Unkn.	—	—	—	—	—	—
	Herschel	Mangwana's Location	1	23	—	—	—	—	—	—
	"	Malefane's "	1	40	—	—	—	—	—	—
	"	Sterkspruit	1	Unkn.	—	—	—	—	—	—
	Komgha	Farm 16 xiii/37	1	17	—	—	—	—	—	—
	"	Farm 20 xiii/38	1	31	—	—	—	—	—	—
	"	Farm 21 xiii/38	1	78	—	—	—	—	—	—
East Coast Fever.	East London ...	Lot 101, Kweleghа, Immigrant Location. Ward 7	1	822	—	—	—	—	—	—
	Komgha	Farm xiii/20	1	482	—	—	—	—	—	—
Glanders ...	Cape	Bellville	2 Clin. af. & destr.	4 Contacts tested.	4	—	—	—	—	—
Scabies (Equine)	Albany	Buffalo Kloof, Salem	—	—	—	—	1	—	—	—
	Uitenhage	Korhaan's Drift	—	—	—	—	1	—	—	—
Tuberculosis ...	Cape	Various	—	—	—	—	—	312	18	2

	Malmesbury ...	„	—	—	—	—	—	51	1	—
	Paarl	„	—	—	—	—	—	20	2	—
	Stellenbosch ...	„	—	—	—	—	—	35	1	—

NATAL.

East Coast Fever	Bergville Division ...	Loskop	9	84	—	—	—	—	—	—
	„ „ ...	Keswick	1	111	—	—	—	—	—	—
	Klip River „ ...	Ruther Glen	4	71	—	—	—	—	—	—
	Lions River „ ...	Riet Spruit	2	15	—	—	—	—	—	—
	Lower Umzimkulu Division ...	Outlook	—	—	—	—	—	—	—	—
	New Hanover Division	Applesbosch	—	—	—	—	—	—	—	—
	Richmond „	Glencairn	9	200	—	—	—	—	—	—
	Zululand, Mtunzini Division	Ginginhlovu Town Lands	—	600	—	—	—	—	—	—
Epizootic Lymphangitis	Lower Tugela ...	Stanger	—	1	—	—	—	—	—	—
	„ „ ...	Nonoti...	—	5	—	—	—	—	—	—
Glanders ...	Richmond	Portion of Nels Rust...	1 clinic affect. & destr.	No in-contacts	—	—	—	—	3	—
Tuberculosis ...	Zululand	Ginginhlovu	—	—	—	—	—	13	1 reactor	2

TRANSVAAL.

East Coast Fever	Piet Retief	Morgenzon No. 205	—	—	—	—	—	—	—	—
	„	Stryd Kraal No. 208	—	—	—	—	—	—	—	—
	„	Potgietershoek No. 186	—	—	—	—	—	—	—	—
	„	Veehoek No. 224	—	—	—	—	—	—	—	—
	„	Athalia No. 48	—	—	—	—	—	—	—	—
Anthrax ...	Standerton	Winklehaak No. 73	4	—	—	—	—	—	—	—
	Marico	Linokana	1	125	—	—	—	—	—	—
	„	Klaastroom	2	41	—	—	—	—	—	—
	Potchefstroom ...	Varkenskraal No. 254	1	40	—	—	—	—	—	—

TRANSVAAL.

Disease.	District.	Area or Name of Farm.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Anthrax ...	Marico	Vanghetbult	1	50	—	—	—	—	—	—
	"	Roodekoppiesput	1	—	—	—	—	—	—	—
	"	Kafoeli No. 320	1	—	—	—	—	—	—	—
	Potchefstroom ...	Wolvepan No. 2	1	300	—	—	—	—	—	—
	" ...	Modderfontein No. 642	1	12	—	—	—	—	—	—
	Krugersdorp ...	Krugersdorp	1	—	—	—	—	—	—	—
	Witwatersrand ...	Springs	1	4	—	—	—	—	—	—
	Krugersdorp ...	Roodepoort	1	3	—	—	—	—	—	—
	" ...	West Rand G. M.	1	—	—	—	—	—	—	—
	" ...	Vogelstruisfontein	1	6	—	—	—	—	—	—
	Lichtenburg ...	Hibernia No. 20	1	100	—	—	—	—	—	—
	" ...	Burghersdorp	1	39	—	—	—	—	—	—
	Witwatersrand ...	Kleinfontein No. 9	1	6	—	—	—	—	—	—
	Middelburg... ...	Witbank No. 146	1	—	—	—	—	—	—	—
	Marico	Klaastroom	1	50	—	—	—	—	—	—
	"	De Putten	1	50	—	—	—	—	—	—
Tuberculosis ...	Witwatersrand ...	Syferfontein No. 2	—	23	—	—	—	23	1	1
	" ...	Alberton	1	65	—	—	—	65	—	—
	Krugersdorp ...	Waterval No. 74	—	37	—	—	—	37	14	—
	Barberton	Concession Creek	1		Not to hand.					
	Pretoria	Zonderwater No. 173	—	13	—	—	—	13	—	—
	Witwatersrand ...	Diepkloof	—	25	—	—	—	25	1	—
	" ...	Klipoortje No. 13	—	48	—	—	—	48	—	—
	Krugersdorp ...	Robinson G. M.	—	—	—	—	—	1	1	—

ORANGE FREE STATE.

Disease.	District.	Area or Name of Farm.	Number of Deaths.	Number of In-contacts.	Number of Animals Reacted to Test and Destroyed.	Number of Animals Tested with Mallein.	Number of Animals Affected.	Number of Animals Tested.	Number of Animals Reacted and Destroyed.	Number of Doubtful Reactors to be Retested.
Anthrax ...	Kroonstad	Normandien	5	200	—	—	—	—	—	—

TRANSKEI.

East Coast Fever	Mount Frere ...	Stephen's Location	14	60	—	—	—	—	—	—
	Butterworth ...	Makinana's Location	42	929	—	—	—	—	—	—
		Skit's, Gcilitshana, Silinga's, Lusipo's and Biliso's Locations	—	—	—	—	—	—	—	—
	Tabankulu	Griffith's and Mdtshwa's Locations	—	—	—	—	—	—	—	—
	St. Marks	Damane's Location	—	—	—	—	—	—	—	—
	Qumbu	Modola's Location	5	144	—	—	—	—	—	—
	„	Xotongo's Location	—	—	—	—	—	—	—	—
	Nqamakwe	Mkatshane's Location	—	—	—	—	—	—	—	—
Glanders ...	Port St. Johns ...	Begumgazi	—	17	3	17	—	—	—	—
	Mount Ayliff ...	Dundee	—	—	1	—	—	—	—	—
Lung-sickness ...	Nqamakwe	Sokapase's Location	—	78	1	—	—	—	—	—
	Engcobo	Nobatana's Location	—	50	4	—	—	50	—	—
	„	Ntego's Location	—	6	1	—	—	—	—	—
	Libode	Ginga's Location	1	22	1	—	—	22	—	—
Anthrax ...	Kentani	Centuli and Robertson's Store, Velebayi's and Ntlangeni's, Sinqambu's, Binase's, Ziqu's, and Nofotyo's Locations	—	—	—	—	—	—	—	—
	Butterworth ...	Mtulu's and Makmana's Locations...	—	—	—	—	—	—	—	—
	Elliotdale	Tubeni	—	—	—	—	—	—	—	—
	Mataticle	Ethelsdale	74	80	—	—	—	—	—	—
	Engcobo	Engcobo Commonage	1	—	—	—	—	—	—	—

Export of Fruit.

THE following returns show the declared value of fresh fruit exported oversea from the Union of South Africa during each of the first four months of the present year :—

JANUARY.

Description.	Via Capetown.	Via Port Elizabeth.	Via East London.	Via Durban.	Via Delagoa Bay.	TOTAL.
	£	£	£	£	£	£
Apples	5	—	—	4		9
Apricots	82	—	-	4		86
Bananas	7	- -	—	37		44
Grapes	213	1	—	10		224
Guavas	—	—	—	—		—
Lemons	4	—	—	5		9
Mangoes	7		-	15		22
Melons	1	2	—			3
Naartjes	-	6	-	—		6
Nectarines	135	10	- -	-		145
Oranges	15	14	—	4		33
Paw-paws	—	—	—	15		15
Peaches	815	-	—	3		818
Pears	232	—		4		236
Pineapples	5	3	1	262		271
Plums	690	2	—	4		696
Other kinds	3	—	—	68		71
TOTAL ... £	2,214	38	1	435		2,688

FEBRUARY.

Description.	Via Capetown.	Via Port Elizabeth.	Via East London.	Via Durban.	Via Delagoa Bay.	TOTAL.
	£	£	£	£	£	£
Apples	14	18		4		36
Apricots	10					10
Bananas	6			23		29
Grapes	2,773		1	5		2,779
Guavas						
Lemons	6		-	5		11
Mangoes	8			32		40
Melons	111					111
Naartjes		5				5
Nectarines	236					236
Oranges	-	7		31		38
Paw-paws				10		10
Peaches	1,696		1	5		1,702
Pears	4,245		1	11		4,257
Pineapples	7	79	1	275		362
Plums	1,550		1	4		1,555
Other kinds	2			55		57
TOTAL ... £	10,664	109	5	460		11,238

MARCH.

Description.	Via Capetown.	Via Port Elizabeth.	Via East London.	Via Durban.	Via Delagoa Bay.	TOTAL.
	£	£	£	£	£	£
Apples	110	3	-	13	-	126
Apricots	1	-		-	-	1
Bananas	8	-		112		50
Grapes	5,604	-	2	27		5,633
Guavas	-			-		- -
Lemons	1			6		7
Mangoes				7		7
Melons	52	1				53
Naartjes						--
Nectarines	50					50
Oranges		10		8		18
Paw-paws				3		3
Peaches	193					193
Pears	3,691		1	8		3,700
Pineapples	2	48	2	76		128
Plums	2,493	-		7		2,500
Other kinds	1			65		66
TOTAL ... £	12,206	62	5	262		12,535

APRIL.

Description.	Via Capetown.	Via Port Elizabeth.	Via East London.	Via Durban.	Via Delagoa Bay.	TOTAL.
	£	£	£	£	£	£
Apples	66	4	-	17		87
Apricots						- -
Bananas	22			40		62
Grapes	2,833			48		2,881
Guavas						--
Lemons	15			1		16
Mangoes						-
Melons	56					56
Naartjes		4		11		15
Nectarines						--
Oranges	3	11		47		61
Paw-paws						
Peaches	14			3		17
Pears	952			24		976
Pineapples	5	116		68		189
Plums	223			2		225
Other kinds	6			45		51
TOTAL ... £	4,195	135		306		4,636

Departmental Notices.

TOBACCO SEED.

The Tobacco and Cotton Division has a quantity of selected and acclimatized tobacco seed of heavy and bright types for distribution during 1913. All applications for seed must be sent to the Chief of the Tobacco and Cotton Division, P.O. Box 516, Pretoria, accompanied by postal orders to cover cost of same.

This seed will be distributed pro ratio at a charge of 1s. per oz.

Turkish Tobacco Seed: The following varieties of Turkish seed can be obtained from the Officer in Charge of Turkish Tobacco Experiments, Stellenbosch. Cape Province, at the prices quoted, viz.:—

Soulook	4s. per oz.
Malcadje	4s. „
Baladovari	4s. „
Dubeck	5s. „

W. H. SCHERFFIUS,
Chief of Tobacco and Cotton Division.

CLEANING AND GRADING TOBACCO SEED.

The Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, are prepared to clean and grade tobacco seed sent to them by farmers free of charge.

The process separates the light from the heavy seed, and the result is that a much larger percentage of the cleaned seed will germinate.

W. H. SCHERFFIUS,
Chief of Tobacco and Cotton Division.

COTTON SEED.

Selected seed of several varieties of American Upland Cotton can be obtained from the Tobacco and Cotton Division, Union Department of Agriculture, Pretoria, at a charge of 3d. per lb.

In every case a remittance must accompany the order for seed.

W. H. SCHERFFIUS,
Chief of Tobacco and Cotton Division.

VETERINARY RESEARCH LABORATORY, ONDERSTEPOORT.

ADMISSION OF VISITORS.

It is hereby notified for the information of the public that visitors cannot be admitted to the Veterinary Research Laboratory at Onderstepoort during working hours on weekdays unless a special permit has previously been obtained from the Secretary for Agriculture.

The most convenient time for visitors to be shown over the Laboratory is Sunday afternoon, when an officer will be specially detailed for the purpose and permits will not be required.

EXPERIMENTAL FARM, POTCHEFSTROOM.

SEEDS FOR DISPOSAL.

Wheat.—Price 12s. 6d. per 100 lb. delivered at buyers' station. This price is subject to alteration without notice.

Early and Medium Early Varieties suitable for Irrigated Land.—Wit Klein Koren; Rooi Wol Koren; Spring; Glujas Early; Eckstein; Bombay; Fourie; Australian (Early); Hawkesbury; Egyptian Red.

These seeds consist of different varieties which have been experimented upon at this Farm, and have proved valuable; the crops thereof have been specially grown for seed purposes.

Application for these seeds should be made on or before the 15th March. No orders will be booked until that date, but applications may then be closed, and the available supply distributed pro rata among the different applicants. In that case only orders which have been then definitely placed will be considered; an inquiry which is still the subject of correspondence will not be considered a definite order. These "seeds" will not be forwarded on the c.o.d. system.

Orders must be accompanied by remittance, and cheques and money orders should be drawn in favour of the Principal, Experimental Farm, Potchefstroom, from whom any further particulars may be obtained.

H. THOMPSON,
for *Principal.*

27th January, 1918.

PIGS FOR SALE.

Large white Yorkshire and Berkshire Pigs are for sale from the Tweespruit Stud Farm, P.O. Tweespruit, and large Blacks and Berkshires from the Roodepoort Stud Farm, P.O. Dewetsdorp. Inquiries should be addressed to the Managers of the farms mentioned.

ORGANIZATION OF DEPARTMENT OF AGRICULTURE.

Administrative Office ... ... Pretoria.
Telegraph Address ... ... "Landbouw, Pretoria."

Secretary for Agriculture: F. B. Smith. Under-Secretaries for Agriculture: P. J. du Toit and A. Holm. Deputy-Accounting Officer: J Collie. Chief Clerk: G. N. Williams. Officer in Charge of Inquiry Office, Capetown: G. W. Klerck.

VETERINARY DIVISION.

This Division endeavours to prevent the introduction of contagious diseases of live stock into the Union and to eradicate such as are already present, and to protect live stock against enzootic diseases by inoculation and other means. So far as it is able to do so without interfering with its other duties, the Division advises and assists farmers upon diseases of stock generally and endeavours to enlighten them upon veterinary hygiene and the care of live stock. For veterinary purposes the Union is divided into five areas, each in charge of Senior Veterinary Officers, who are responsible for the control of disease within these areas.

Principal Veterinary Officer: C. E. Gray. Assistant Principal Veterinary Officer: J. D. Borthwick.

Cape Province.—Senior Veterinary Officer: R. W. Dixon, Government Offices, Parliament Street, Capetown. Government Veterinary Officers: C. S. Elphick, Vryburg; E. Fern, Capetown; A. Matthews, Capetown: G. W. Freer, Uitenhage; R. I Jones, East London; J. H. L. Lyons, East London; J. Nichol, Kingwilliamstown; W. G. Pakeman, Queenstown; and W. A. Simson, Cradock.

Transvaal.—Senior Veterinary Officer: J. M. Christy, Department of Agriculture, Pretoria. Government Veterinary Officers: R. S. Garraway, Pretoria; W. G. Evans, Volksrust; P. Conacher, Johannesburg; J. G. Bush, Krugersdorp; T. H. Dale, Potchefstroom; H. M. Webb, Zeerust; J. M. Tate, Rustenburg; J. Chalmers, Nylstroom; J. I. Edgar, Pietersburg; G. Lee, Lydenburg; G. C. Webster, Barberton; D. B. J. McCall, Ermelo; and G. May, Standerton.

Natal.—Senior Veterinary Surgeon: W. M. Power, Colonial Buildings, Pietermaritzburg. Government Veterinary Surgeons: S. H. Ewing, Eshowe; A. F. Harber, Point, Durban; S. I. Johnston, Maritzburg; F. J. Hill, Bulwer; A. Goule, Maritzburg; J. L. Webb, Mooi River; C. Tyler, Ladysmith; and F. Hutchinson, Dundee.

Orange Free State.—Senior Veterinary Surgeon: A. Grist, Government Buildings, Bloemfontein. Goverument Veterinary Surgeons: J. F. Joyce, Ficksburg; J. A. A. Hamilton, Kroonstad; F. M. Skues, Bethlehem; C. H. Wadlow, Smithfield; and C. T. Clemow Frankfort.

Transkeian Territories.—Senior Veterinary Officer: J. Spreull, Umtata. Government Veterinary Surgeons: A. C. Kirkpatrick, A. M. Howie, T. M. Doyle, W. A. Dykins, A. Goodall, G. T. Henerson, and J. A. Worsley.

DIVISION OF VETERINARY RESEARCH.

The duty of this Division is the investigation of diseases of live stock with a view to discovering methods of eradicating them or of protecting animals against them. It examines and reports upon pathological specimens forwarded by the Veterinary Division and farmers and prepares vaccines and sera of various kinds, and also mallein, tuberculin, and other diagnostic and preventive agents.

Opportunities are offered to post-graduate students for the carrying out of special investigations and a great deal of educational work is performed by the Division.

The Division is in close touch with and is complementary to the Veterinary Division. Director of Veterinary Research: Dr. A. Theiler. Assistant Director of Veterinary Research: W. Robertson. Superintendent: E. Parkes. Professional Assistants: D. T. Mitchell, W. H. Andrews, D. Kehoe, F. Veglia, W. Jowett, G. N. Hall, G. A. H. Bedford, A. W. Shilston (Pietermaritzburg), and J. Walker (Grahamstown).

DIVISION OF SHEEP.

This office is charged with:—(a) Eradication of scab; (b) improvement of pastora ndustries; (c) the management of the Stud Sheep Farm at Ermelo; (d) the improvement of the flocks maintained on the various Experimental Farms; and (e) the control of the Field Cornets in the Transvaal Province.

Chief of Division: B. G. L. Enslin. Principal Sheep Inspector: A. G. Davison. Principal Sheep and Wool Expert: Charles Mallinson.

For the better carrying out of the work in connection with scab, the Union is divided into twenty-four areas in charge of Senior Sheep Inspectors; these areas are in turn divided into 297 inspection districts, each in charge of an Inspector. In addition there are ten Inspectors employed on the railway lines for the prevention of the movement of infected stock by rail. There are also five whole-time Inspectors employed on certain large commonages.

A similar organization is adopted in respect of the improvement of sheep and wool.

Orange Free State Province.—Sheep and Wool Expert: J. F. McNab, Bloemfontein. Assistant Sheep and Wool Expert: A. V. M. Suter, Bloemfontein.

Cape Province.—Sheep and Wool Expert: W. M. McKee, Queenstown. Assistant Sheep and Wool Experts: E. V. Goddefroy, Worcester; P. S. Taylor, Steynsburg.

Transvaal Province.—Western District Assistant Sheep and Wool Expert: A. M. Spies, Headquarters not yet fixed. Eastern District Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal.

Natal Province.—Assistant Sheep and Wool Expert: J. J. McCall, Cedara, Natal. This area includes the East Griqualand District of the Cape Province.

Manager, Ermelo Stud Sheep Farm: A. G. Michaelian.

DIVISION OF ENTOMOLOGY.

This Division obtains and disseminates information relative to beneficial and injurious "insects." In collaboration with the Division of Plant Pathology, it administers the law relating to the introduction of plants into the Union and by the inspection of nurseries and other methods, it endeavours to control injurious "insects" present in the Union; it is also responsible for the destruction of locusts.

Chief of Division: C. P. Lounsbury. Entomologists: Claude Fuller and C. P. v. d. Merwe, Pretoria; C. W. Malley, Capetown; .... Bloemfontein; and C. B. Hardenberg, New Hanover, Natal (investigating wattle insects).

DIVISION OF BOTANY.

This Division is concerned with the investigation of the merits of indigenous plants of economic importance and of poisonous plants and noxious weeds, the identification of plants, the introduction and testing of economic plants from abroad and the improvement of farm crops by breeding.

Chief of Division: J. Burtt-Davy. Herbarium Assistant: Miss C. Stent.

DIVISION OF PLANT PATHOLOGY AND MYCOLOGY.

This Division in engaged in the investigation and control of diseases of plants, produced by fungous and physiological causes, and the study and collection of fungi of economic importance.

Chief of Division: I. Pole Evans. Professional Assistants: Miss E. M. Doidge and P. v. d. Byl.

DIVISION OF TOBACCO AND COTTON.

The object of this Division is the promotion of the tobacco and cotton industries Experiments are conducted in the breeding and growth of tobacco and cotton and in the curing, fermentation, and preparation of tobacco for the market. Approved varieties of tobacco and cotton seed are distributed amongst farmers and advice given to them personally and by correspondence and publications.

Chief of Division: W. M. Scherffius. Tobacco Warehouse Expert: T. E. Elgin. Expert for Turkish tobacco, Western Province, Cape: L. M. Stella, "La Motte," Paarl. Manager, Experiment Station, Rustenburg: H. W. Taylor. Manager, Experiment Station, Barberton: W. B. Wilson. Manager, Tzaneen Estate: E. H. F. Powell. Manager, Experiment Station, Piet Retief: R. Falgate. Manager, Cotton Experiment Station, East London: D. D. Brown.

DIVISION OF DAIRYING.

This Division deals with a l matters connected with the advancement of dairying. The Division also controls the Cold Stores at Vryburg.

Superintendent of Dairying : E. O. Challis. Senior Inspector :..............................
Instructors : *Cape Province.*—T. R. Carruthers, Government Offices, Parliament Street, Capetown, and C. Schmolke, Queenstown. *Orange Free State.*—W. Oosterlaak, Government Buildings, Bloemfontein. *Natal.*—.............................., Colonial Office, Pietermaritzburg. *Transvaal.*—L. J. Veenstra, Department of Agriculture, Pretoria.

DIVISION OF HORTICULTURE.

This Division advises farmers on the growing and marketing of fruit, including table grapes and raisin drying, and grades fruit for export.

Chief of Division : R. A. Davis. Horticulturist in charge of Experiment Station, Warmbaths : C. A. Simmonds. Horticulturist in charge of Experiment Station, Ermelo : R. le Sueur. Instructor in Horticulture, Cape Province : S. W. van Niekerk, Bovenvallei, Wellington.

DIVISION OF VITICULTURE.

This Division is charged with the duty of advising farmers in all matters relating to the culture of the vine (excluding table grapes and raisin-making) and the manufacture of wine and brandy, and vinegar. It conducts field investigations into the suitability of various stocks, the use of fertilizers, modes of cultivation, etc., and investigates the diseases of the vine, and conducts both cellar and laboratory experiments in the making of wine and brandy. It examines pathological specimens and furnishes reports thereon, and examines chemically and bacteriologically specimens of the products above mentioned with a view to furnishing advice thereon to farmers.

This Division also includes the Government Wine Farm, Groot Constantia, where advice can be obtained by residents in the Wynberg and Hout Bay areas.

Government Viticulturist : A. J. Perold, Œnological Station, Paarl, Cape Province. Manager, Government Wine Farm, Groot Constantia : T. L. Watermeyer.

OFFICE OF GUANO ISLANDS.

This office undertakes the conservation, collection, shipment, and sale to the public of the guano, seal skins, etc., obtained on the various islands belonging to the Union, and is charged with the administration of all matters connected therewith.

Superintendent : W. R. R. Zeederberg, 69 Strand Street, Capetown.

DIVISION OF CO-OPERATION.

This Division is engaged in promoting co-operation for the sale and purchase of agricultural products and necessities amongst farmers and in organizing and supervising co-operative societies.

Chief Inspector : C. H. Keet. Inspectors : J. Retief and H. Minnaar.

DIVISION OF CHEMISTRY.

This Division investigates problems of general or special importance, and for the present undertakes the analysis of soils, manures, and foodstuffs for farmers in the Transvaal, the analysis of similar matters in the other Provinces being undertaken in the laboratories of the Department of the Interior at Capetown, Grahamstown, Maritzburg, and Bloemfontein, pending the enlargement of the chemical laboratories at the agricultural schools and experiment stations.

The analyses are conducted solely for the enlightenment of the farmers and not for legal purposes.

Chemist : H. J. Vipond. Laboratory Assistant : L. Bischoff.

DIVISION OF FENCING AND BRANDS.

This Division administers the laws relating to fencing and brands, and publishes the Brands Directory, required by the Transvaal Act.

Controller of Fencing and Registrar of Brands : W. J Nussey.

OFFICE OF HOUSEHOLD SCIENCE.

The duties of this office are to promote the study of household science by means of lectures, demonstrations, and correspondence.

Lecturer and Instructor : Miss J. C. van Duyn.

DIVISION OF DRY-LAND FARMING.

This Division conducts experiments and disseminates information on dry-land farming. An Experiment Station is maintained at Lichtenburg, with subsidiary ones at Pretoria, Warmbaths, and Pietersburg. Experiments in dry-farming are also conducted at the agricultural schools and experiment stations, and at other centres.

Dry land Agronomist and Manager, Experiment Station, Lichtenburg : H. S. du Toit.

DIVISION OF GRAIN INSPECTION.

This Division undertakes the grading of grain at the ports prior to export, and, if requested to do so, determines the amount of moisture present in grain intended for export.

Chief Inspector of Grain: G. F. Nussey. Government graders are stationed at the docks at Capetown, Port Elizabeth, East London, and Durban.

DIVISION OF PUBLICATIONS.

This Division edits the *Agricultural Journal* and other departmental publications.

Editor: Dr. W. Macdonald.

LIBRARY.

The object of the Library is to provide as complete a collection of agricultural literature as possible for the purpose of reference.

Librarian: P. Ribbink.

AGRICULTURAL SCHOOLS AND EXPERIMENT STATIONS.

The duties of these institutions are to provide complete courses of education extending over a period of two years and shorter courses of a technical character for persons actually engaged in farming, to instruct farmers in the area served by them on matters relating to the various phases of farming by means of personal visits, lectures, demonstrations, and correspondence. To conduct experiments, to analyse soils, manures, dairy products, etc., and to identify plants and insects and test seeds. A certain amount of pure-bred stock and of new and approved varieties of seeds are produced on the farms and disposed of to the public.

The institutions do not undertake the administration of laws relating to agriculture.

Elsenburg School of Agriculture and Experiment Station.—Station: Mulder's Vlei; distance, 1½ miles.

Sub-stations at Malmesbury and Robertson.

Principal	Dr. A. I. Perold.
Lecturer in Veterinary Science	R. Paine.
„ Horticulture	L. Tribolet.
„ Chemistry	D. C. Crawford.
„ Engineering	W. H. Chandler.
„ Botany and Plant Breeding	J. H. Neethling.
„ Dairying	J. Gow.
„ Agriculture	F. Fowlie.
Farm Manager	Vacant.
Agricultural Assistant	C. L. R. de Wet, George.

Grootfontein School of Agriculture and Experiment Station.—Station: Middelburg, Cape Province; distance, 2 miles.

Principal	R. W. Thornton.
Lecturer in Agriculture	G. J. Bosman.
„ Veterinary Science	J. A. Robinson.
„ Engineering	E. A. Morris.
„ Chemistry	W. R. S. Ladell.
„ Zoology and Entomology	R. O. Wahl.
„ Dairying	J. Anderson.
„ Sheep and Goats	E. N. C. Warren.
„ Poultry	A. Little.
„ Farm Manager	Van der Merwe.

Agricultural Assistants: J. Meldal Johnson, Humansdorp; A. K. Hards, Cathcart; W. J. Lamont, Grootfontein; and Mr. Melle, Vryburg.

Cedara School of Agriculture and Experiment Station.—Station: Cedara, on farm sub-station at Winklespruit.

Principal	E. Harrison.
Lecturer in Chemistry	C. Williams.
„ Biology	J. Fisher.
„ Veterinary Science	F. J. Curless.
„ Dairying and Poultry	A. Lawrence.
„ Horticulture	C. R. Parsons.
Farm Manager	W. C. Mitchell.

Potchefstroom School of Agriculture and Experiment Station.—Station: Potchefstroom; distance, 1½ miles.

Principal	E. J. Macmillan.
Vice-Principal	H. Thompson.

Lecturer in Chemistry ...	T. G. Reinecke.
" Botany	T. O. Bell.
" Zoology and Entomology	W. Moore.
" Veterinary Science	J. R. Quinlan.
" Engineering	W. S. H. Cleghorne.
" Poultry	R. Bourlay.
" Horticulture	W. Sturm.
" Dairying	J. B. Fisher.
" Agriculture	A. M. Bosman.
Farm Manager	Alex. Reid.

STUD FARMS.

At these farms pure-bred animals, mainly horses, are maintained and bred for lease and sale to farmers.

Standerton Stud Farm.—Station: Standerton; distance, 11 miles. General Manager: A. McNae.

Tweespruit Stud Farm.—Station: Tweespruit, on farm. Manager: J. J. Morton.

GOVERNMENT WINE FARM, GROOT CONSTANTIA.

VISITORS' DAYS.

It is notified by the Secretary for Agriculture that it has been decided that persons shall be allowed to visit the Government Wine Farm at Groot Constantia between the hours of 9 a.m. and 5 p.m. on Mondays, Tuesdays, and Thursdays.

EXPERIMENT FARM, CEDARA.

PURE-BRED POULTRY AND SITTINGS OF EGGS FOR SALE.

Cockerels of the following breeds are now available for sale from the Cedara Experiment Farm, Natal:—

Plymouth Rock, White Wyandotte, White Leghorn, and Buff Orpington, 7s. 6d. to 15s. each, f.o.r. buyer's nearest station (in Natal only) at buyer's risk.

Sittings of eggs from Plymouth Rock, White Wyandotte, English and American White Leghorns, Buff and White Orpingtons, and Indian Game fowls, will be for sale during September and October at 10s. per sitting f.o.r. buyer's nearest station (in Natal only). Guaranteed fertile on dispatch, and will be replaced only if returned, carriage paid, in box in which originally dispatched from Cedara. Egg-boxes charged 6d. each.

Applications to be made to the Principal, School of Agriculture, Cedara, Natal.

ACCESSIONS TO DEPARTMENTAL LIBRARY.

LIST OF COMPLETE WORKS ACQUIRED DURING FEBRUARY AND MARCH, 1913.

Barclay, S. A.—"On a New Species of Uredine Parasitic on Cedrus Deodara." Calcutta, 1886. (Deposited with the Plant Pathologist.)

Board of Agriculture and Fisheries.—"Edible and Poisonous Fungi." London, 1910. (Deposited with Plant Pathologist.)

Bodin, Dr. E.—"Les Champignons Parasites de l'Homme." Paris, 1902. (Deposited with Plant Pathologist.)

Burri, Robert.—"Ueber einige zum Zwecke der Artcharakterisirung anzuwendende bacteriologische Untersuchungen." München, 1893. (Deposited with Plant Pathologist.)

Cavers, F.—"Practical Botany." London, 1911.

Chapman, Alf. C., and F. G. S. Baker.—"An Atlas of the Saccharomycetes." London, 1906. (Deposited with Plant Pathologist.)

Cooke, M. C.—"Catalogue and Field-book of British Basidiomycetes." London, 1908. (Deposited with Plant Pathologist.)

Cooke, M. C., and Rev. M. J. Berkeley.—"Fungi: their Nature, Influence, and Uses." London, 1883. (Deposited with Plant Pathologist.)

Dadant, Rev. Ch.—"Langstroth on the Hive and Honey Bee." Hamilton, Illinois, U.S.A., 1911.

De Candolle, M.—"Sur les Champignons Parasites." (Deposited with Plant Pathologist.)

Doolittle, G. M.—"A Year's Work in an Out-Apiary." Ohio, 1910.

"Scientific Queen-rearing as Scientifically and Practically Applied." Chicago, 1909.

Dykes, W. R.—"Irises." London, 1912.

Ellis, J. B., and F. W. Anderson.—"New Species of Montana Fungi." (Deposited with Plant Pathologist.)

Ellis, J. B., and B. L Everhart.—"Some New Species of Hymenomycetous Fungi." (Deposited with Plant Pathologist.)

Ellis, J. B., and B. L. Everhart.—"New Species of Fungi from various Localities." (Deposited with Plant Pathologist.)

"New Species of Tropical Fungi." (Deposited with Plant Pathologist.)

"New and Rare Species of North American Fungi." (Deposited with the Plant Pathologist.)

Ewart, A. J.—"Plants Indigenous to Victoria." Vol. 2. (Melbourne, 1910.)

Farrer, R.—"The Rock Garden." London, 1912.

Fink, Bruce.—"The Lichens of Minnesota." Washington, 1910. (Deposited with Plant Pathologist.)

Grubb, E. H.— The Potato." New York, 1912.

Hand, J. E.—"Bee-Keeping by the XXth Century Methods." Medina, 1911.

Harmand, l'Abbé J.—"Lichens de France." Paris, 1912. (Deposited with Plant Pathologist.)

Hooker, W. M., and Rev. M. J. Berkeley.—"The English Flora." Vol. 5, Fungi. (Deposited with Plant Pathologist.)

Inoko, Dr. Y.—Toxikologisches ueber einen japanischen Giftschwamm." (Deposited with Plant Pathologist.)

Knight, Ch.—"Contributions to the Lichenographia of New South Wales." London, 1882. (Deposited with Plant Pathologist.)

"Contributions to the Lichenographia of New Zealand. (Deposited with Plant Pathologist.)

Kolle, Dr. W., and Dr. A. von Wassermann.—"Handbuch der Pathogenen Mikrooganismen." Band IV, 2te Auflage. (Deposited with Director of Veterinary Research)

Leighton and Thwaites.—"The Lichens of Ceylon." (Deposited with Plant Pathologist.)

Lochhead, M.—"Lochhead's Guide, Handbook, and Directory of Pretoria." Pretoria, 1913.

Lydekker, R.—"The Horse and its Relatives." London, 1912.

MacBride, T. H., and A. Allin.—"The Saphohytic Fungi of Eastern Iowa: Puff-Balls." (Deposited with Plant Pathologist.)

Massee, Geo.—"Redescriptions of Berkeley's Types of Fungi." London, 1896. (Deposited with Plant Pathologist.)

"The Fungus Flora of New Zealand." (Deposited with Plant Pathologist.)

Minchin, E. A.—"An Introduction to the Study of the Protozoa." London, 1912. (Deposited with Plant Pathologist.)

National Rose Society.—"Hints on Planting Roses." 1912.

"Catalogue of Roses." 1912.

"Handbook of Pruning Roses." 1912.

"National Rose Society. Arrangements for 1912. List of Members, etc."

Passey, Louis.—"Histoire de la Societé National d'Agriculture de France." Tome I, 1761-1793. Paris, 1912.

Philo, E. W.—"A Little Poultry and a Living."

"Making Poultry Pay by the Philo System." New York, 1911.

Philo National Poultry Institute. A Series of Lessons: Parts 1-10.

"The Philo System of Progressive Poultry-Keeping." New York, 1911.

Pickering, S. U., and F. V. Theobald.—"Fruit Trees and their Enemies with a Spraying Calendar." London, 1908.

Poisson. Henry.—"Récherches sur la Flore Meridionale de Madagascar." Paris, 1912.

Rathay, Emerich.—"Untersuchungen ueber die Spermogenien der Rostpilze."

Root, H. H.—"Alexander's Writings on Practical Bee-Culture." Medina, 1910.

Root, L. C.—"Quinby's New Bee-Keeping." New York, 1911.

Scot, J. W. R. (Home Counties.)—"A Free Farmer in a Free State." London, 1912.

Spegazini, Carolo.—"Fungi Argentini." Buenos Aires, 1899. (Deposited with Plant Pathologist.)

Swanton, E. W.—"Fungi and how to know them." London, 1909. (Deposited with Plant Pathologist.)

Townsend, E. D.—"Townsend Bee-Book." Medina, 1910.

Willmot, Ellen.—"The Genus Rosa." 24 parts. London, 1910-12.

Wright.—"On Fungi Parasitic on Insects, etc." (Deposited with Plant Pathologist.)

Wolff, Henry W.—"Co-operation in Agriculture." London, 1912.
Zimmermann, A. R—"Das Genus Mucor." Chemnitz, 1871. (Deposited with Plant Pathologist.)

The following is a list of complete works acquired during the month of April, 1913:—

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